
Effective Early Childhood Education Programs: A Systematic Review

Bette Chambers

University of York and
Johns Hopkins University

Alan Cheung

Johns Hopkins University

Robert E. Slavin

University of York and
Johns Hopkins University

Dewi Smith

Success for All Foundation

Mary Laurenzano

Johns Hopkins University

September, 2010

This research was funded by the CfBT Education Trust. However, any opinions expressed are those of the authors and do not necessarily represent CfBT positions or policies. Our appreciation goes to Diana Dugan, Susan Davis, and Michele Victor who also helped with locating and organizing the studies.

Abstract

This report systematically reviews research on the outcomes of programs that teach young children in a group setting before they begin kindergarten. Study inclusion criteria included the use of randomized or matched control groups, evidence of initial equality, and study duration of at least 12 weeks. Studies included valid measures of language, literacy, phonological awareness, mathematical, and/or cognitive outcomes that were independent of the experimental treatments. A total of 38 studies evaluating 27 different programs met these criteria for outcomes assessed at the end of preschool and/or kindergarten.

The review concludes that on academic outcomes at the end of preschool and/or kindergarten, six early childhood programs showed strong evidence of effectiveness and five had moderate evidence of effectiveness.

A few longitudinal studies have followed their subjects into secondary school, and even adulthood. These studies show that comprehensive programs focused broadly on cognitive development rather than solely academic skills had better long-term effects on social adjustment outcomes such as reductions in delinquency, welfare dependency, and teenage pregnancy, and increases in educational and employment levels.

Effective Early Childhood Education Programs: A Systematic Review

The education of young children who are at risk for school failure is widely recognized as an important factor in determining future school success. Previous reviews of programs for children between the age of three and entry into kindergarten demonstrate that early childhood education is a worthwhile investment (Barnett, Frede, Mosbasher, & Mohr, 1987; Reynolds, Temple, Robertson, & Mann, 2001).

Various researchers have found that for each dollar spent on preschool, somewhere between four and eight dollars is saved in later social service costs to society (Barnett, 2007; Karoly & Bigelow, 2005). In addition to short-term effects on academic achievement, long-term effects of several programs include fewer arrests, fewer teen pregnancies, and higher employment (Gilliam & Zigler, 2000).

Recent brain research and research on cognitive development are reinforcing evidence that early education is crucial in getting children off to a good start in life (Bowman, Donovan, & Burns, 2001; Magnuson, Meyers, Ruhm, & Waldfogel, 2003). Based in part on this research, local and national policymakers are establishing new early childhood programs, and trying to improve the quality of the ones that exist.

While evaluations of Head Start and other early childhood programs in the U.S. and other countries have clearly shown positive effects of early education, in comparison to no services, the important question before researchers and policy makers today is what kind of preschool program is most effective for young children? Which particular programs have positive outcomes and what elements of these programs contribute to their effectiveness?

The present report reviews the evidence for the effectiveness of various preschool/nursery programs for young children who are at risk of school failure due to poverty. It reviews the research on the outcomes of early childhood programs provided in a group setting for all children, applying consistent methodological standards to the research. The aim of this review is both to assist educators and policy makers in deciding on the types of programs to implement and to inform researchers about the current evidence on preschool programs and guide further research. The scope of the review includes all types of programs that principals or child care directors might consider adopting to prepare their children for success in elementary school and beyond.

Previous Reviews

Most previous reviews of preschool interventions have focused on the question of whether or not preschool attendance influences future school success (e.g., Currie, 2000; Gilliam & Zigler, 2000; Gorey, 2001; Karweit, 1993). Some of these reviews carried out cost-benefit analyses of various forms of early education (Barnett, 1993; Penn et al. 2006). Only a few however, have made comparisons among different types of interventions (Barnett, 1995;

Chambers, Cheung, & Slavin, 2006; White, Taylor, & Moss, 1992).

White's (1992) meta-analytic review concluded that early intervention benefitted most children, but could not determine which types of interventions were most effective. Barnett (1995) reviewed 36 studies of preschool attendance, Head Start, child care, and home visiting programs. He concluded that early childhood interventions (compared to no preschool) generally have large short-term effects on intelligence measures and sizable effects on school achievement, grade retention, special education placement, and social adjustment. However, he was not able to compare alternative preschool programs.

Based on the early reviews of long-term effects of preschool programs, new programs have been developed in recent years. Most of these new programs take a cognitive developmental perspective and combine elements of direct instruction for the whole class and small groups, along with times when children individually choose activities. There is usually a focus on developing children's language and emergent literacy. Many recent studies have evaluated these new programs, and often the experimental programs from past studies (e.g., High/Scope, Creative Curriculum) are now the control condition in recent studies.

The Chambers et al. (2006) review compared traditional, academic, and cognitive-developmental early childhood programs and found that academic programs generally produced better immediate and mid-term cognitive outcomes. However, cognitive-developmental programs produced better long-term educational and social adjustment outcomes. In addition to curriculum, another factor that differentiated programs was the degree of support that the teachers are provided in implementing the curriculum.

Camilli and his colleagues (Camilli, Vargas, Ryan, & Barnett, 2009) conducted a meta-analysis of the effects of early education interventions on cognitive and social development. Using data from 123 studies, they included both studies that compared early childhood interventions to a no intervention group and those that compared alternative interventions. Their conclusions echoed those of previous reviews in that they reported significant effects of attending a preschool program on social, school progress, and particularly cognitive outcomes but reported few differences in outcomes of alternative treatments.

In a more focused meta-analysis of the effects of early childhood curricula on children's receptive and expressive vocabulary, Darrow (2009) evaluated 17 early childhood curricula. Drawing on data from 29 separate studies, Darrow concluded that early childhood curriculum interventions, taken together, did not differ from their respective control groups on vocabulary development by the end of preschool, nor at the end of kindergarten. However, she could not determine the impacts of particular programs.

The UK Centre for Excellence and Outcomes (C4EO) (Coghlan et al., 2009) recently presented findings from a rapid review of research and national data to improve outcomes for children in the early years, particularly for children living in poverty, children from ethnic minorities, and children with English as an additional language (EAL). The review identified practices with children from birth to seven years of age published since 2000. They found that

poverty affects more than 2.9 million children and young people in the UK, especially Pakistani, Bangladeshi, and black non-Caribbean children. Poor children do worse academically and make less progress in learning throughout the early years. Most of the associations between ethnicity and child outcomes are related to poverty and being an English language learner.

The review found strong evidence that implementing focused and sustained system-level strategies for remediating child and family poverty can significantly improve the range of outcomes for young children. It suggests making greater use of targeted interventions and trained bilingual staff and educating mainstream early years professionals in working with English language learners. It recommends providing high-quality preschool learning environments and ensuring that children from the most disadvantaged and poor families take up places at those preschools.

The review suggests providing sufficient free play to enable children to explore their own interests and take responsibility for their own learning, and training teachers to provide sufficient opportunities for ‘sustained shared thinking’ by interacting with children and asking open-ended questions.

The report recommends that these goals could be achieved by having strong leadership in curriculum and planning, high staff qualifications, low turnover, opportunities for professional development, and support for effective home learning environments.

None of the recent reviews have evaluated the strength of the research base for particular programs. Several key evaluations of early childhood programs have recently been conducted, notably the Preschool Curriculum Research Evaluation, a U.S. Department of Education cross-site evaluation of 14 different early childhood programs (Preschool Curriculum Evaluation Research Consortium, 2007). The present review focuses on these and other evaluations of alternative approaches to preschool education.

Focus of the Review

The purpose of this review is to place the findings of studies of all types of early childhood programs intended to enhance school readiness on a common scale, to provide educators and policy makers with meaningful, unbiased information that they can use to select programs most likely to benefit their children’s school readiness. The review emphasizes practical programs that are or could be used at scale. To make the review most useful to educators and policy makers, it emphasizes large studies done over significant time periods that used standard measures. It also identifies common characteristics of programs likely to make a difference in achievement. This synthesis was intended to include all kinds of reliable approaches to early childhood education.

Methodological Issues Unique to Early Childhood Education

While a review of research on early childhood programs shares methodological issues common to all systematic reviews, there are also some key issues unique to early childhood education. One of these relates to measurement. We intended to include the impacts of interventions on children's social and emotional development. However, the vast majority of the data on these outcomes comes from teacher or parent ratings of children's behavior, rather than on unbiased observations of children's actual behavior. Because teacher and parent ratings can be influenced by their knowledge of being in a study and of the goals of the particular intervention, we could only include objective, observational measures of children's behavior. Unfortunately, there were not enough such studies to report in this review. Therefore, the outcomes summarized here focuses on academic and cognitive outcomes.

There is always a possibility that outcomes seen at the end of preschool just reflect the focus of a given program. For example, programs that introduce phonics or math skills earlier than usual are likely to show positive effects on measures of phonics or math skills respectively at the end of preschool, which may or may not be maintained after control groups receive similar content in kindergarten or first grade. Program evaluations that follow children at least through the end of kindergarten and into elementary school are of particular value for this reason. There is a small set of studies that have followed children into adulthood. The review presents separately a small set of longitudinal studies that report long-term outcomes.

Review Methods

This review uses a form of best evidence synthesis (Slavin, 1986), adapted for use in reviewing "what works" literatures in which there are generally few studies evaluating each of many programs (see Slavin, 2008). Best-evidence syntheses apply consistent, well-justified standards to identify unbiased, meaningful information from experimental studies, discussing each study in some detail, and pooling effect sizes across studies in substantively justified categories. The method is very similar to meta-analysis (Cooper, 1998; Lipsey & Wilson, 2001), adding an emphasis on narrative description of each study's contribution. See Slavin (2008) for an extended discussion and rationale for the procedures used in all of these reviews.

Search Procedures

The Centre for Reviews and Dissemination (CRD) at the University of York conducted an exhaustive initial search to locate all studies that have compared alternative approaches to early childhood education from 1960 to the present. Studies from all countries were included, as long as the studies were available in English.

Databases searched included: JSTOR, ERIC, EBSCO, Psych INFO, and Dissertation Abstracts. Search terms used were different combinations of key words (preschool, nursery, prekindergarten, compensatory education, school readiness, child care) and program names (e.g., HighScope, Creative Curriculum, Abecedarian, Perry Preschool, Montessori, Reggio Emilia,

Project Approach, Project Construct). Studies published in refereed journals, technical reports, dissertations, or unpublished evaluations, were all included.

Manual searches of the following journals were conducted: *American Educational Research Journal*, *Harvard Educational Review*, *Journal of Experimental Education*, *British Journal of Educational Psychology*, *Educational Evaluation and Policy Analysis*, *Educational Research Quarterly*, *Child Study Journal*, *Reading and Writing*, *Early Education and Development*, *Literacy Research and Instruction*, and *Journal of Education for Students Placed at Risk*. Citations from other reviews were followed up (e.g., Chambers, Cheung, & Slavin, 2006; Currie, 2000; Gilliam & Zigler, 2000; Gorey, 2001; Karweit, 1993; Barnett, 1995; White, Taylor, & Moss, 1992).

Titles and abstracts were downloaded onto an Endnote X1 database and studies were de-duplicated. All potentially relevant papers were retrieved. Data were extracted and coded by one reviewer using a standard procedure and at least 25% were checked by another reviewer. Disagreements were resolved by discussion and consensus and, if necessary, a third reviewer was consulted. This search yielded 1,698 articles. Of these, 38 studies of 27 different programs met the inclusion criteria described in the following section.

Inclusion criteria

The studies evaluated programs and practices for the education of groups of young children. Studies of parenting programs, nutrition interventions, and programs for individual children, such as home visitation programs, were not reviewed. The studies involved children between the ages of three and five or in the year or two before they began kindergarten.

The studies compared children taught in classes using a given program or specified replicable practice to those using an alternative program or standard practices. Studies that only compared preschool attendance to non-attendance were not included. The group setting could be prekindergarten or nursery classes in elementary schools, child-care centers, Head Start centers, or Sure Start centers. Any early childhood setting that offered a regularly scheduled educational program to a group of preschoolers was included.

Studies designed specifically to meet the needs of non-English-speaking children or children with special needs were not included in this review. If programs began in infancy and continued through preschool, such as the Carolina Abecedarian Study (Campbell & Ramey, 1995), they were excluded if it was impossible to determine the effects of the preschool intervention alone.

Initial Equivalence

Random assignment or matching with appropriate adjustments for any pretest differences (e.g., analyses of covariance) had to be used. If at least 30 children were randomly assigned to conditions and they were well matched on demographics, then we did not require a pretest. If

they were not randomly assigned, there needed to be evidence of initial equality on assessments similar to posttest measures. Studies with differences of more than 50% of a standard deviation on key indicators of initial equality, such as receptive language, were excluded because, even with analyses of covariance, large pretest differences cannot be adequately controlled for as underlying distributions may be fundamentally different.

Studies without control groups, such as pre-post comparisons and comparisons to “expected” scores, were excluded. Studies in which parents selected their children to be placed into treatments (e.g., chose to attend a particular school program) or were specially selected into treatments (e.g., gifted programs) were excluded unless experimental and control groups were designated after selections were made.

Sample Size

Studies needed to have at least two teachers and 25 individuals per condition in the analysis with no indications of initial inequality.

Immediate Outcomes

The dependent measures included quantitative measures of phonological awareness, oral language, emergent literacy (e.g., alphabet knowledge, concepts of print), emergent mathematics, or cognitive measures. Experimenter-made measures were accepted only if it could be determined that they assessed skills equally addressed in the control groups as well as the experimental groups.

Measures of objectives inherent to the intervention, but unlikely to be emphasized in control groups, were excluded. This included measures in which the children’s teachers rated their social or cognitive skills or behaviors. Teachers in the treatment groups might have had their perceptions of the children’s behavior influenced by their knowledge of being in a study and knowing the goals of the intervention.

Intermediate Outcomes

Most studies that followed children into kindergarten, or further into elementary school, measured children’s language, literacy, or mathematics outcomes. Others determined children’s educational outcomes, such as grade retention, school attendance, and/or special education referrals.

Long-term Outcomes

A few key studies have followed subjects into secondary school and even adulthood. The outcomes that were included to assess the long-term effects of the interventions were education and social adjustment factors such as delinquency/crime, employment, welfare dependence, teenage pregnancy, and graduation from high school and higher education.

Duration

A minimum study duration of 12 weeks was required. This requirement was intended to focus the review on practical programs and practices intended for extended use, rather than brief investigations. Brief studies may not allow programs to show their full effect. On the other hand, brief studies often advantage experimental groups that focus on a particular set of objectives during a limited time period while control groups spread instruction over a longer period. However, studies with brief treatment durations that measured outcomes over periods of more than 12 weeks were included, as long as the time between pretest and post-test was at least 12 weeks, on the basis that if a brief treatment has lasting effects, it should be of interest to educators. For example, if a study administered a pretest, provided six weeks of intensive tutoring, and then gave an immediate posttest, it would not be included, but if students were given a follow-up test 20 weeks after pretest, that score would be included as the outcome of the intervention.

Sometimes the impacts of an intervention become more apparent well after the immediate post-test. This is especially true for literacy outcomes, because literacy is not assessed in preschool, but gains in vocabulary or other cognitive skills have later effects on reading. For this reason, in the summary table and rating scale, we report outcomes for the end of preschool and the end of kindergarten.

A few notable studies of preschool interventions have been reported numerous times. Sometimes this is due to the longitudinal nature of the studies, as with the Consortium for Longitudinal Studies, which followed the subjects from early interventions to determine the long-term impacts (Lazar & Darlington, 1982). For these redundant reports we were careful to code each outcome only once and to use the most recent report available.

Effect Sizes

In general, effect sizes were computed as the difference between experimental and control individual student post-tests after adjustment for pretests and other covariates, divided by the unadjusted post-test control group standard deviation (SD). If the control group SD was not available, a pooled SD was used. Procedures described by Lipsey & Wilson (2001) and Sedlmeier & Gigerenzor (1989) were used to estimate effect sizes when unadjusted standard deviations were not available, as when the only standard deviation presented was already adjusted for covariates or when only gain score SD's were available. If pretest and post-test means and SD's were presented but adjusted means were not, effect sizes for pretests were subtracted from effect sizes for post-tests.

Effect sizes were pooled across studies for each program and for various categories of programs. This pooling used means weighted by the final sample sizes. The reason for using weighted means is to maximize the importance of large studies, as small studies tend to overstate effect sizes (see Rothstein et al., 2005; Slavin, 2008; Slavin & Smith, 2009).

Effect sizes were broken down for measures of language, literacy, phonological awareness, mathematics, cognition, and educational outcomes.

Limitations

It is important to note several limitations of the current review. First, the review focuses on experimental studies using quantitative measures of outcomes of early childhood interventions. There is much to be learned from qualitative and correlational research that can add depth and insight to understanding the effects of these programs. However, to compare the effectiveness of programs, one needs quantitative evidence that can be evaluated on a common scale.

Second, the review focuses on replicable programs used in realistic early childhood settings expected to have an impact over periods of at least 12 weeks. This emphasis is consistent with the review's purpose in providing educators with useful information about the strength of evidence supporting various practical programs, but it does not attend to shorter, more theoretically-driven studies that may also provide useful information, especially to researchers.

Third, the review focuses on academic and cognitive outcomes, and does not attend to important social-emotional outcomes.

Finally, the review focuses on traditional measures of academic and cognitive outcomes, primarily individually-administered standardized tests. These are useful in assessing the practical outcomes of various programs and are fair to control as well as experimental groups. However, the review does not report on experimenter-made measures of content taught in the experimental group but not the control group, although results on such measures may also be of importance to researchers or educators.

We would have included independent observations of children's social behaviors, but there were not enough studies with this kind of independent data to include social-emotional outcomes in the review.

Categories of Research Design

Four categories of research designs were included in this review. *Randomized experiments* were those in which students, classes, or schools were randomly assigned to treatments, and data analyses were at the level of random assignment. When schools or classes were randomly assigned but there were too few schools or classes to justify analysis at the level of random assignment, the study was categorized as a *randomized quasi-experiment* (Slavin, 2008). *Matched* studies were ones in which experimental and control groups were matched on key variables at pretest, before post-tests were known, while *matched post-hoc* studies were ones in which groups were matched retrospectively, after post-tests were known. Studies using fully randomized designs are preferable to randomized quasi-experiments, but all randomized experiments are less subject to bias than matched studies. Among matched designs, prospective designs were preferred to post-hoc designs.

Presentation of Findings

Key study characteristics, student outcomes, and study quality are summarized in a narrative and tables. Where appropriate data were available from two or more studies of a similar intervention, a quantitative synthesis was undertaken. A narrative synthesis was conducted where a quantitative synthesis was considered inappropriate statistically or from an educational perspective.

To make the findings for each program more easily understandable and usable for educators searching for programs with evidence of effectiveness, the programs are presented on a rating scale. This is a modified version of a rating system that Slavin (2008) developed for the Best Evidence Encyclopedia (www.bestevidence.org) to balance methodological quality, weighted mean effect sizes, sample sizes, and other factors. The categories of effectiveness are as follows.

Strong Evidence of Effectiveness

Programs in this category were evaluated in at least two studies, one of which is a large randomized or randomized quasi-experimental study, or multiple smaller studies, with a sample size-weighted effect size of at least +0.20, and a collective sample size across all studies of 250 students or 20 classes. The effects can be on any of the academic or cognitive outcomes, at the end of preschool and/or kindergarten.

Moderate Evidence of Effectiveness

Programs in this category were evaluated in at least one randomized or two matched studies of any qualifying design, with a collective sample size of 125 students or 10 classes, and a weighted mean effect size of at least +0.20 across all measures in a particular domain.

Limited Evidence of Effectiveness: Strong Evidence of Modest Effects

Programs in this category have studies that meet the criteria for ‘moderate evidence of effectiveness’ except that the weighted mean effect size is +0.10 to +0.19 across all measures in a particular domain.

Limited Evidence of Effectiveness: Weak Evidence with Notable Effects

Programs in this category have studies that have a weighted mean effect size of at least +0.20, but do not qualify for ‘moderate evidence of effectiveness’ due to insufficient numbers of studies or small sample sizes.

Insufficient Evidence of Effectiveness

Qualifying studies do not meet the criteria for ‘limited evidence of effectiveness.’

N No Qualifying Studies

Programs in this category do not have any qualifying studies.

Summaries of Programs and Studies

This section of the review contains brief descriptions of the programs that were included in the review and of the studies that evaluated their impacts. Programs were reviewed in alphabetical order. Table 1 presents the effect sizes for each outcome in each included study for each program. Table 2 presents the means for each program, weighted by sample size, for each outcome for the immediate effects and for the end of kindergarten where a follow-up was conducted.

TABLES 1 and 2

In some cases, a number of programs were evaluated in one study. In these cases, the overall design of the study is presented just before the first program is introduced and then referred back to when subsequent programs from that study are presented. An example is the Preschool Curriculum Evaluation Research (PCER), described below.

Preschool Curriculum Evaluation Research

Between 2002 and 2005, the Preschool Curriculum Evaluation Research (PCER) Program conducted evaluations of 14 different preschool curricula with two independent external evaluators and 12 PCER grantees who received grants beginning in June 2002 or 2003 to compare one or two different curricula to a control condition. In randomized experiments conducted during the preschool year, the children were followed until the end of kindergarten. The external evaluators (Mathematica and RTI) administered a battery of nine measures designed to assess children's cognitive, language, beginning reading, math, and writing skills. It was designed to take no more than one hour to complete. The components of the child assessment included: Social Awareness Tasks; Peabody Picture Vocabulary Test—3; Test of Early Language Development—Phonemic Awareness Subtest and Grammatical Understanding Subtest; Test of Early Reading Ability—3rd Edition; Child Math Assessment Abbreviated; Shape Composition Task; Color Naming and Counting Task; and the Letter-Word Identification, Applied Problems, and Spelling Subtests of the Woodcock-Johnson III. The measures were administered in the fall of preschool, in the spring of preschool, and again in the spring of kindergarten. Below, under each of the different curricula studied, the PCER findings are summarized but the methods are not repeated for each PCER evaluation presented. Teacher and parent interviews and ratings of children's behavior were also collected but they are not included in this review as the parents and teachers were aware of the condition that the children were in and may have been biased in their perceptions by that fact.

Breakthrough to Literacy

Breakthrough to Literacy is a systematic and integrated literacy and language program published by the Wright Group, which aims at promoting language development and literacy

skills among preschool children. The program uses systematic, direct instruction built around a series of weekly books in the classroom. Interactive computer programs are also used to engage students in individualized activities, and are organized around the weekly book, to support their literacy skills and print knowledge.

Abt Associates (2007) carried out an 18-month study in Miami-Dade County, Florida, to examine the impacts of three intervention programs on teacher behaviors, classroom environments, and student outcomes—*Ready, Set, Leap!*, *Building Early Language and Literacy* (BELL), and *Breakthrough to Literacy* (BTL). (See sections on the other curricula for their impact.) One hundred sixty-two centers in Miami-Dade County were randomly assigned to one of the treatment groups or a control condition that used ordinary preschool approaches. To be eligible for the study, a center had to primarily serve low-income children and at least one class of four-year-old children with at least five children. In centers where there was more than one class of four year olds, the class with the most low SES children was chosen. Children were pretested in autumn, 2003 and post-tested in kindergarten (spring, 2005). Teachers in the treatment conditions received initial training prior to the study. In addition, follow-up trainings and ongoing mentoring support were provided over the course of the study. Hierarchical linear models were used to analyze the data with age, gender, language spoken at home, and classroom mean pretest scores as covariates. At the end of kindergarten, students who received *Breakthrough to Literacy* (N=354) outperformed the control group (N=509) on averaged literacy measures (ES = +0.48) and phonological awareness (ES = +0.44, $p < 0.000$).

Bright Beginnings

Bright Beginnings is an integrated curriculum with a focus on language and early literacy. The curriculum goals are to provide a child-centered, literacy-focused program that is consistent and to include instruction that addresses the needs of the whole child. The curriculum was especially designed to provide continuity in the preschool to second-grade curricula. *Bright Beginnings* includes nine curriculum units that focus on language and literacy, mathematics, social and personal development, healthful living, scientific thinking, social studies, creative arts, physical development, and technology. The classroom environment is designed to encourage children's active exploration and interaction with adults, other children, and concrete materials. The curriculum also includes a parent involvement component that requires parents to be actively engaged in the child's education.

PCER (2008). As part of the PCER evaluation, researchers from Vanderbilt University evaluated *Bright Beginnings* and *Creative Curriculum*. This summary focuses on the description and findings for *Bright Beginnings*. For the PCER findings for *Creative Curriculum*, see the summary for that curriculum.

Twenty-one full-day, public prekindergarten classrooms in seven school districts in Tennessee participated in the PCER study. The children were 80% White, 18% African American, and 11% Hispanic and were 4.5 years old at the time of baseline data collection. Of the 309 children who participated in the study, 103 were in the *Bright Beginnings* treatment group, 101 in the *Creative Curriculum* treatment group, and 105 in the control group. In the

control classrooms, teachers used teacher-developed curricula with a focus on basic school readiness. A non-significant mean effect size of +0.31 across literacy outcomes at the end of preschool had faded by the spring of kindergarten to +0.03. Limited effects were found for two language measures at preschool (ES = +0.11). No differences were apparent on phonological awareness at preschool (ES = -0.07) or kindergarten (ES = +0.01), or on 3 measures of mathematics at preschool (ES = +0.06) or kindergarten (ES = +0.12).

Building Blocks Mathematics

The *Building Blocks* curriculum provides students with small-group math sessions of 10 - 15 minutes once a week, along with whole-class activities four times a week for 5-15 minutes. Parents are continuously updated on these activities and encouraged to do home-based supplemental activities through letters sent home each week.

Clements & Sarama (2008) compared the Building Blocks preschool math curriculum to both another innovative comparison math curriculum and a control condition in a randomized control trial. Based in New York State, the study involved 276 students and 35 teachers within a variety of preschool settings. The control classes received the standard mathematics instruction used prior to the study. The other innovative comparison group was excluded due to large pretest differences between them and the control group. Children were individually pretested at the beginning of the study and post-tested after the intervention ended. After 26 weeks of instruction, children in the treatment group scored significantly higher than the controls in their overall Early Math Assessment scores after adjusting for pretest differences, with an effect size of +1.06.

Clements, Sarama, Lee, Lange, & Spitler (2009) evaluated the effects of *Building Blocks* in a large-scale two-year study with 43 schools and 1375 children in two schools districts, one in Buffalo, NY, the other in Boston, MA. They found significant effects on mathematics (ES = +0.72) but no significant effects on language or literacy.

Across the two studies, weighted by the sample sizes, there was an effect size of +0.77 for the standardized mathematics outcomes.

Building Early Language and Literacy (BELL)

Building Early Language and Literacy (BELL) is a preschool supplementary program aimed at promoting preschoolers' general language proficiency, phonological awareness, shared reading skills, and print knowledge. Children receive two 15-20 minutes lessons daily. Children's literature is used in classrooms to build vocabulary and promote awareness of story sequencing and characters. The program also includes shared reading time and phonological awareness time to support reading skills and phonetic reading techniques.

Abt Associates (2007) carried out an 18-month study in Miami-Dade County to examine the impacts of three intervention programs on teacher behaviors, classroom environments, and child outcomes—*Ready, Set, Leap!*, *Building Early Language and Literacy* (BELL), and *Breakthrough to Literacy* (BTL). (See the *Breakthrough to Literacy* section for details of the

method.) No statistically significant differences were found between the *BELL* group (N=340) and the control group (N=509). Effect sizes were as follows Effect sizes were as follows - averaged literacy measures (ES = +0.07) and phonological awareness (ES = -0.04).

Creative Curriculum

Creative Curriculum is a comprehensive approach to education for three- to five-year-old children. The curriculum addresses four areas of development - social/emotional, physical, cognitive, and language development. *Creative Curriculum* requires the physical space of the classroom to be structured into 10 interest areas: blocks, dramatic play, toys and games, art, library, discovery, sand and water, music and movement, cooking, and computers. Time is also allotted for outdoor activities. The 10 interest areas are designed to address curriculum content, such as literacy, mathematics, science, social studies, the arts, and technology, in a fairly unstructured setting designed to promote children's process skills, such as observing, exploring, and problem solving. *Creative Curriculum* includes a Developmental Checklist teachers are asked to use in ongoing assessments of child progress.

PCER (2008). As part of the PCER project, researchers from Vanderbilt University evaluated *Bright Beginnings* and *Creative Curriculum*. This summary focuses on the description and findings for *Creative Curriculum*. For the PCER findings for *Bright Beginnings*, see the summary for that program. Twenty-one full-day, public prekindergarten classrooms in seven school districts in Tennessee participated in the PCER study. The children were 4.5 years old at the time of baseline data collection and were 80% White, 18% African American, and 11% Hispanic. Of the 309 children who participated in the study, 103 were in the *Bright Beginnings* treatment group, 101 in the *Creative Curriculum* treatment group, and 105 in the control group. In the control classrooms, teachers used teacher-developed curricula with a focus on basic school readiness. No significant impacts on the prekindergarten or kindergarten child outcomes were evident. Effect sizes across literacy measures were +0.12 at preschool and +0.24 at kindergarten, +0.15 at preschool and +0.12 at kindergarten for two language measures, +0.10 at preschool and +0.06 at kindergarten for phonological awareness, and +0.13 at the preschool and +0.07 at kindergarten for three math measures.

A research team from the University of North Carolina at Charlotte also evaluated *Creative Curriculum* as part of the PCER project. They recruited full-day Head Start programs in North Carolina and Georgia. There were eight classrooms in North Carolina and 10 classrooms in Georgia. A sample of 18 classrooms and 194 children (97 treatment, 97 control) participated in the study. The children were 85% African American and 4.5 years old at the time of baseline data collection. In the control condition, teachers used teacher-developed, nonspecific curricula.

Teachers within centers were randomly assigned to condition. At the end of the pilot year, the North Carolina site retained eight (four treatment and four control) of the 10 classrooms. Two classrooms were dropped because they were funded by the state's *More at Four* program, had teachers with at least university degrees, and had problems with high rates of teacher attrition. The Georgia site retained 10 out of 10 classrooms.

No significant impacts on the preschool or kindergarten child outcomes were found for the PCER study. Effect sizes for literacy outcomes averaged -0.11 at pre-k and +0.03 at kindergarten, for language outcomes -0.03 at pre-k and -0.01 at kindergarten, for phonological awareness +0.02 at pre-k and +0.06 at kindergarten, and for math +0.10 at pre-k and +0.07 at kindergarten.

Averaging across these two evaluations, a weighted mean effect size for literacy outcomes of +0.01 was found at pre-k and +0.11 at kindergarten, for language +0.06 at both pre-k and kindergarten, for phonological awareness +0.06 at both pre-k and kindergarten, and for math +0.12 at pre-k and +0.07 at kindergarten.

Curiosity Corner

Curiosity Corner is a comprehensive cognitive-developmental program developed by the Success for All Foundation. It aims to develop the attitudes, skills, and knowledge necessary for later school success with an emphasis on children's language and literacy skills. *Curiosity Corner* comprises two sets of 38 weekly thematic units, one for three-year-olds and one for four-year-olds. Each day teachers present children with learning experiences through sequential daily activities. The program provides training, support, and teaching materials for teaching staff and administrators. Parents are encouraged to participate in children's learning through activities both inside and outside the classroom.

Curiosity Corner was also one of 14 curricula evaluated in a randomized field trial in the Preschool Curriculum Evaluation Research (PCER) project. Eighteen high-poverty preschool sites in three states with 215 children in total were randomly assigned to implement *Curiosity Corner* or continue with their regular instruction. Children were tested on a battery of measures in the fall and spring of preschool and followed up in the spring of their kindergarten year. Adjusting for pretest scores, there were no significant differences at the end of preschool but there were significant differences favoring the *Curiosity Corner* preschool attendees on literacy at the end of kindergarten (ES = +0.39) and non-significant effect sizes of +0.15 for language, +0.25 for phonological awareness, and +0.18 for mathematics.

Chambers, Chamberlain, Hurley, and Slavin (2001) evaluated *Curiosity Corner* in high-poverty communities in New Jersey. Two age groups participated in the study. The first group was 169 three-year-old children enrolled in privately run early childhood centers and the second group was 147 four-year-old children attending publicly run preschool classrooms. Each group was compared to a comparison group matched on demographic characteristics. The majority of the children were African American. PPVT pretests were administered to establish a baseline. At the end of the school year, the children were tested on three language subtests of Mullen Scales of Early Learning (MSEL). Children in the three-year-old *Curiosity Corner* classes scored significantly higher on expressive language than their counterparts in the control group. The combined three- and four-year-old effect size was +0.24 for expressive language. No significant differences were found on children's receptive language (ES = +0.06).

Demonstration and Research Center for Early Education DARCEE

The *DARCEE* program was a direct instruction model, didactic in nature like *Direct Instruction*, but focused more on association, classification, and sequencing, along with the development of such aptitudes as achievement motivation, task persistence, and delay of gratification.

The Louisville Experiment. In an experiment in Louisville, Kentucky, Miller and Dyer (1975) compared four different programs: two academic programs (*Direct Instruction* and *DARCEE*), one cognitive-developmental (*Montessori*), and a traditional control group. In 1968, 214 four-year-old children were randomly assigned to the four programs in Head Start classes in Louisville. There was a no-preschool control group that was excluded from our analyses because it had a non-equivalent, more advantaged group of children. Children attended classes daily from September 1968 to June 1969. About one quarter of the children attended a token economy Follow Through kindergarten program. There were small negative effects of *DARCEE* compared to traditional instruction on cognition at the end of preschool (ES = -0.11) and kindergarten (ES = -0.11). The long-term follow-up study is reported in the section on longitudinal evaluations.

Dialogic Reading

Dialogic Reading is an emergent literacy intervention program developed by Whitehurst and his colleagues (1994). The program is an interactive story reading program aimed at improving the oral language and listening comprehension abilities of young children. Children in the *Dialogic Reading* program are encouraged to switch roles with their teacher to become the storyteller during small-group shared reading practice. The teacher assumes the role of active listener and questioner, helping children to improve their oral and language skills in the reading process. In a typical *Dialogic Reading* program, parents are also involved in the process by reading to their child daily using the same books that their child used during dialogic reading in class.

Whitehurst et al. (1994) evaluated the *Dialogic Reading* program in five day-care centers in Suffolk County, New York. A total of 73 three-year-olds were pretested on several standardized tests of language ability and were randomly assigned within classrooms to one of three conditions in a six-week intervention: 1) a school plus home reading condition in which children were read to by both teachers and their parents; 2) a school reading condition in which children were read to only by teachers; and 3) a control condition in which children participated in play activities under the supervision of their teachers. The students were 55% African American and 23% Hispanic. In the school reading condition, children were engaged in *Dialogic Reading* with a teacher in a small group setting, usually no more than five children. In addition, students participated in a daily shared reading session for approximately 10 minutes with their reading group. In the school plus home reading condition, students were engaged in the same dialogic reading session as in the school reading condition. In addition, their parent or primary care taker was encouraged to read to their children at home after being trained to use dialogic

reading. Children were post-tested after the six-week intervention and again at a six-month follow-up. Although the intervention was only six weeks, the study was included because a follow-up was conducted at six months, making the time between the pretest and post-test sufficiently long to determine ongoing effects. No significant differences were found on language scores at the six-month follow-up ($ES = -0.03$) or at the end of kindergarten, first, or second grades (Whitehurst et al., 1999).

Direct Instruction

Direct Instruction (DI) is a program first developed by Bereiter and Englemann (1966) as an instructional method for at-risk children. DI is a teacher-directed program in which specific cognitive and literacy skills are broken down into small units and taught explicitly. Teachers follow highly scripted lesson plans and techniques in their lessons. The main focus of the program is on basic academic concepts, such as arithmetic and reading.

Engelmann (1968), in a small matched study involving both disadvantaged and middle class students, examined the effectiveness of *Direct Instruction* on IQ and achievement in reading and arithmetic. Students were well matched on initial IQ, gender, ethnicity, and SES. The 15 disadvantaged children in the experimental group attended three 20-minute sessions daily—a language concept class, an arithmetic class, and a reading class, for two years beginning at age four. In contrast, twenty-eight disadvantaged children in the control group attended a regular preschool program, which emphasized play and traditional nursery school activities. In addition to the disadvantaged children, a comparison group of 18 middle-class children attending a *Montessori* school were added to the study to demonstrate the differential effects of the experimental program, but these data were excluded because there were no pretests to determine equivalency.

Children were administered a Stanford Binet IQ test after the first and second year of instruction. At the end of preschool, the experimental group outperformed the control group on the IQ test with an effect size of $+0.66$. At the end of the second year (kindergarten), the experimental group again outscored the control group with an effect size of $+1.34$. Note that this is after two years of *Direct Instruction* intervention, not an assessment of the lasting effects of a preschool-only intervention, as are the end-of-kindergarten results for most of the other programs.

The Louisville Experiment. In their Louisville experiment, Miller and Dyer (1975) compared four different programs: *Direct Instruction*, *DARCEE*, *Montessori*, and traditional instruction. See details of the study in the description of *DARCEE*. There were small positive effects for *Direct Instruction* on cognitive skills at the end of preschool ($ES = +0.11$) that faded by kindergarten (-0.02). A follow-up study is reported in the section on longitudinal evaluations.

Salaway (2008) examined the additive effects of DI in addition to a developmentally appropriate preschool (DAP) curriculum. A total of sixty-one preschoolers were randomly assigned to either the *Language for Learning* (DI-Add-On) curriculum or the DAP-only curriculum group. Approximately 70% of the participants were African American, 20% White,

and 10% others. Children in the treatment group were instructed by the trained teachers three days a week in the morning during small group activity. All participating children were tested on two measures prior to the intervention: K-SEALS and DIBELS. After the six-month intervention, all children received post-test assessments. Outcomes at the end of preschool showed children in the experimental group outperformed controls on literacy (ES = +0.52), language (ES = +0.46), and mathematics (ES = +0.37).

In addition, the weighted mean effect sizes across the two other studies showed effects at the end of preschool on cognition (ES = +0.31), which continued through kindergarten (ES = +0.39). There were no kindergarten data on the other outcomes.

DLM Early Childhood Express supplemented with Open Court Reading Pre-K

A Florida State University research team implemented the *DLM Early Childhood Express* comprehensive curriculum in conjunction with the *Open Court Reading Pre-K* literacy-focused curriculum as part of the PCER project. We describe this combination of the two curricula as a separate program, compared to a control group, as the effects were only reported for the two programs combined. In the control condition, teachers were provided with the *High/Scope* curriculum.

The *DLM Early Childhood Express Program* is a comprehensive curriculum, designed to promote children's social, emotional, intellectual, aesthetic, and physical development through the use of hands-on learning experiences. The curriculum has 36 weekly themes that address the following content areas: literacy, mathematics, science, social studies, fine arts, health/safety, personal/social development, physical movement, and technology. Each thematic unit includes more than 200 age-appropriate, hands-on learning activities that are designed to promote children's social, emotional, intellectual, aesthetic, and physical development.

The *Open Court Reading Pre-K* curriculum content is presented in eight thematic units that address children's identity, families, friends, social interactions, transportation, the physical senses, nature, and transitions. Phonological, phonemic, and print-awareness activities are incorporated into each lesson. Each day, teachers read literature selections that focus on a thematic topic. The curriculum includes a home component that provides parents with suggestions for activities that they can engage in at home with their children.

By integrating the literacy-focused instruction from *Open Court Reading Pre-K* with the comprehensive instructional framework of *DLM Early Childhood Express*, children received instruction that was intended to provide them with a strong foundation in oral language and print awareness as well as research-based instruction in phonics and early decoding and comprehension skills.

PCER (2008). As part of the PCER (2008) evaluation, the Florida State University research team recruited public prekindergarten programs for participation in the study. Two teachers from each of the 16 participating schools were recruited to participate. All of the programs were full-day programs. The final study sample included 30 teachers and classrooms

across three conditions (nine control, 10 *Literacy Express*, and 11 *DLM Early Childhood Express supplemented with Open Court Reading Pre-K*). There was a total of 297 children (99 in the *Literacy Express* treatment group; 101 in the *DLM Early Childhood Express supplemented with Open Court Reading Pre-K* treatment group; and 97 in the control group). Data were collected on a total of 282 children and 270 parents at the time of the September baseline data collection. The children were 4.6 years of age at baseline, with the majority of the sample of preschoolers being African American (59%) or White (30%).

The evaluators conducted repeated-measures linear spline analyses of the three reading assessments to control for a statistically significant pretest difference on the WJ Letter Word Identification test (ES = +0.41). Controlling for the pretest difference, outcomes at the end of preschool showed children in the experimental group outperformed controls on literacy (ES = +0.55), language (ES = +0.40), phonemic awareness (ES = +0.32), and mathematics (ES = +0.26).

Analyses controlling for the pretest difference indicated that effects for the experimental group were sustained through spring of kindergarten, for an average effect size of +0.49 for literacy outcomes, +0.47 for language outcomes, +0.38 for phonological awareness, and +0.23 for math. This combined program had the largest impact on for language and literacy outcomes of any program in the PCER project.

Doors to Discovery

The *Doors to Discovery* curriculum is a preschool program that is based on the areas identified as important for literacy success: oral language, phonological awareness, concepts of print, alphabet knowledge, writing, and comprehension. The program focuses on the use of learning centers and shared literacy activities in the preschool classroom. The curriculum is presented in eight thematic units that cover topics such as friendship, communities, nature, society, and health. Classroom practices include large and small group teacher-directed activities and children's application of skills and independent practice on activities that are related to the themes. The curriculum components also include family learning activities that are designed to foster partnerships between the school and the family; initial training for teachers and ongoing professional development support; and assessment strategies that are integrated into the curriculum units.

Assel et al. (2007) conducted a one-year matched study of the *Doors to Discovery* program in 22 schools including Head Start centers and a large public school district in greater Houston, Texas (both Title 1 and non-Title 1 classrooms). The sample represented an economically and ethnically diverse population that matched on pretests. Two hundred and six students were assigned to the experimental condition, while 203 were in the control condition. Sites differed in approaches to teaching English language learners. In the school district, monolingual Spanish-speaking children were in classrooms where English was the language of instruction. In Head Start, Spanish speaking children were instructed in English and Spanish, thus having language and literacy concepts presented in both languages. Finally, half of the *Doors* classroom teachers received mentoring by senior level trainers, while the other half did

not. There were a total of 25 classrooms implementing *Doors to Discovery* and 27 control classrooms. The results showed a mean effect size of -0.20 on standardized language scales. A test of phonological awareness showed an effect size of +0.12. Another comparison in this study involved *Let's Begin with the Letter People* (see below).

PCER (2008). *Doors to Discovery* was one of the curricula evaluated in the PCER project by the University of Texas Health Science Center at Houston along with *Let's Begin with the Letter People*. These programs were separately compared to a control group, implementing teacher-developed, nonspecific curricula. *Doors to Discovery* and its control were implemented in full-day Head Start and public prekindergarten (Title I and non-Title I) programs in Texas. Forty-four teachers/classrooms, and 297 parents and children (101 in *Doors to Discovery* treatment group, 100 in the *Let's Begin with the Letter People* treatment group, and 96 in the control group) were selected for inclusion in the study sample for the PCER project. The children were on average 4.6 years of age at the time of baseline data collection and more than half (55%) were male. The racial/ethnic composition of the sample of children was diverse: 43 percent Hispanic, 30 percent White, and 13 percent African American. Effect sizes at the end of preschool were +0.16 for literacy, +0.18 for language, and 0.00 for mathematics. Experimental-control differences were non-significant on all measures at the end of kindergarten with +0.12 for language but slightly negative effects for other outcomes.

Early Literacy and Learning Model

The Early Literacy and Learning Model (ELLM) is a literacy-focused curriculum and support system designed for young children from low-income families. The ELLM program includes curriculum and literacy building blocks, assessment for instructional improvement, professional development for literacy coaches and teachers, family involvement, and collaborative partnerships. The ELLM curriculum and support system is designed to enhance existing classroom curricula by specifically focusing on children's early literacy skills and knowledge. The ELLM curriculum materials include a set of literacy performance standards; monthly literacy packets; targeted instructional strategies; resource guides for teachers; a book lending library; and literacy calendars. ELLM requires a two-hour block of daily literacy and language instruction. Trained literacy coaches provide instructional support to preschool teachers who use the curriculum.

The *ELLM* program contains a family involvement action plan. Parents receive monthly family tip sheets and calendars with suggestions for literacy activities they could engage in with their children. Parents also have the opportunity to engage in preschool site-based family activities during the school year. Teachers target instruction in phonological awareness and letter recognition specifically for individual children based on baseline assessments.

PCER (2008). As part of the PCER project, a University of North Florida (UNF) team implemented the *Early Literacy and Learning Model (ELLM)* in 28 preschool classrooms from three geographic locations in Florida. The sampled classrooms included Head Start, subsidized faith-based, and early intervention prekindergarten classrooms. All of the classrooms were full-day programs. Twenty-eight classrooms and teachers participated in the study. The *ELLM* curriculum was implemented in combination with the existing comprehensive curricula that were

in use in the control group classrooms in Florida. Several curricula were used in the control classrooms including *Creative Curriculum*, *Beyond Centers and Circletime*, *High Reach*, and *High/Scope*.

No significant effects were found on prekindergarten child outcomes with effects sizes of +.07 for literacy, +0.16 for language, +0.18 for phonemic awareness, and -0.01 for mathematics. However, ELLM had a delayed effect on language outcomes in kindergarten (ES = +0.39), with small effects on kindergarten measures of literacy (ES = +0.11) phonological awareness (+0.08), and math (ES = +0.08).

In a supplement to the PCER (2008) study, Cosgrove (2006) also evaluated *ELLM*. The study sample was comprised of 466 four-year-old preschoolers in 48 classrooms in multiple settings. In the treatment sites, *ELLM* was implemented in combination with the existing curricula (*Creative Curriculum*, *High/Scope*, and *High Reach*). The controls used only the existing curricula. The treatment group (N=222) scored significantly higher than the control groups (N=244) with an average effect size for literacy scores being +0.25.

The weighted mean effect sizes for *ELLM* across the two studies at kindergarten was +0.11 for literacy, +0.08 for phonological awareness, and +0.08 for mathematics with a strong effect for language of +0.39.

Exemplary Model of Early Reading Growth and Excellence (EMERGE)

EMERGE is a literacy-based program designed to help children from low-income families acquire early literacy skills. The program supports children's development of four early literacy skills. Its goals include the use of research-based teaching practices, progress monitoring to identify the need for more intensive intervention, provision of a literacy-rich learning environment, and continuous professional development. The curriculum increases the amount of time children are engaged in interactive shared book reading and includes theme-based activities. The program also includes family involvement and home-based activity components.

Gettinger & Stoiber (2007) of the University of Wisconsin designed and implemented the *EMERGE* program, which incorporates a response-to-intervention (RTI) model. They evaluated the model in a matched one-year study, implemented in 15 classrooms housed in five center-based early childhood centers. The participating classrooms provided full-day, year-round programming for children across two consecutive years prior to kindergarten. A total of 342 students were enrolled, 188 assigned to the experimental condition, and 154 to the control condition. Ten Head Start classrooms were randomly selected to serve as a control group. Both experimental and control groups were matched on pretests and demographics, which included low SES and 90% African-American participants. *EMERGE* children outperformed those in the control classrooms in three categories, with a mean effect size in literacy of +0.37, in language of +0.13, and in phonological awareness of +0.28, at the end of preschool.

Interactive Book Reading

The *Interactive Book Reading Program*, developed by Wasik and Bond (1994) at Johns Hopkins University, is designed to promote the language and literacy proficiency of young children. The program is an adaptation of the *Dialogic Reading* program, but where *Dialogic Reading* is usually used in a one-on-one or small group setting, the interactive book reading program is designed for use in a whole class setting. As in *Dialogic Reading*, teachers actively engage their children in shared reading time by asking open-ended questions, encouraging them to use newly acquired vocabulary from the book, and providing opportunities to elaborate on what children read and hear. Teachers are given sets of trade books and concrete objects that represent the target vocabulary in these trade books. In addition, teachers receive specific instruction on interactive book reading strategies—defining target words, providing opportunities for children to use vocabulary from the books, asking open-ended questions, and offering children opportunities to talk and to be heard. Prior to reading time, teachers introduce to their children a set of target words with the aid of concrete objects. After reading the story, children are encouraged to use these target words in the extended activities.

Wasik & Bond (2001) conducted a 15-week study of the impact of the *Interactive Book Reading* program on preschoolers. Participants were 121 children from a public early childhood center in Baltimore, Maryland. Most of the children were African American and eligible for free or reduced lunch. Four teachers were randomly assigned to either treatment or control conditions, making this a randomized quasi-experiment. All children were pretested individually on PPVT and post-tested on three measures of vocabulary. At the end of the study, treatment children substantially outperformed control children on language measures with an effect size of +1.33.

Wasik, Bond and Hindman (2006) conducted a similar study, but with more enhanced training for teachers in the use of discourse strategies to enhance children's oral language development. Teachers were encouraged to use the materials and strategies throughout the school day. The three key components in the program included: 1) asking questions, 2) building vocabulary, and 3) making connections. Two Head Start centers were randomly assigned to treatment and control conditions with a total of 207 students from low socio-economic families, mostly African Americans. The children were pretested in autumn and post-tested in spring on three measures. At post-test, treatment children scored significantly higher than control children on language measures for an average effect size of +0.58. No significant difference was found on alphabet knowledge between the two groups.

Averaging across these two studies, the weighted mean effect size on children's language outcomes was +0.86.

Ladders to Literacy

Ladders to Literacy is a supplementary early literacy and language development curriculum for preschool and kindergarten children. It includes skill-building activities that are organized by print awareness; metalinguistic awareness; and oral language. Teachers are

encouraged to select the activities that they want to implement and incorporate those activities into their daily classroom schedule. Teachers are provided with guidance on how to scaffold learning to individualize children's learning of language and literacy skills.

PCER (2008). As part of the PCER (2008) study, a University of New Hampshire research team selected a common subset of 27 activities that all *Ladders to Literacy* treatment group teachers used throughout the school year. For this evaluation, *Ladders to Literacy* was implemented as a supplementary curriculum to the *Creative Curriculum*. Classrooms in the control condition implemented *Creative Curriculum* without the supplement.

The researchers recruited 14 full-day and half-day Head Start classrooms in New Hampshire to participate in the study. A sample of 123 children (62 treatment, 61 control) participated. The children were 4.6 years old at the time of baseline data collection and less than half (44%) were male. The racial/ethnic composition of the sample of children was diverse: 39 percent White, 11 percent African American, and 31 percent Hispanic. No significant effects on preschool or kindergarten student-level outcomes were found, and all effect sizes were slightly negative at both age levels.

Language-Focused Curriculum

The *Language-Focused Curriculum (LFC)* was developed at the University of Kansas (Bunce, 1995) for use with three- to five-year-old children with language limitations, including children with language impairment, children from disadvantaged backgrounds, and English-language learners. The curriculum has a thematic organization and focuses on the use of daily dramatic play to teach and use linguistic concepts. There are both teacher-led and child-led activities with explicit attention to oral language development that is enhanced by high-quality teacher-child conversations. Teachers use eight specific language stimulation techniques when interacting with children in the classroom, such as event casts (descriptions of an activity while it is taking place) and expansions (repeating the child's utterance with varied vocabulary) (Justice, Mashburn, Pence & Wiggins, 2008).

PCER (2008). As part of the PCER (2008) study, researchers from the University of Virginia implemented the *LFC* in seven full-day Head Start and public prekindergarten classrooms in Virginia, with seven control classrooms, with a total of 195 children. The children were 4.6 years of age at the time of baseline data collection and slightly more than half (53%) were male. The majority of the sample was White (71%) or African American (21%). The control teachers reported using *High/Scope* curriculum materials. No significant impacts on preschool or kindergarten child outcomes were found. There was a small effect on literacy (ES = +0.17) at the end of preschool which had faded by kindergarten.

Let's Begin with the Letter People

Let's Begin with the Letter People emphasizes early language and literacy development through play. In addition to classroom teaching, the program has a strong home/parent component. The curriculum is arranged in the following five themes: 1) All About Me, 2)

Animals, Animals, and Animals, 3) Everyone Has Needs, 4) Getting Along with Others, and 5) Nature All Around Us.

Fischel et al. (2007) carried out a one-year study to evaluate the effectiveness of *Let's Begin with the Letter People* and the *Waterford Early Reading Program* (see the *Waterford* section for effects for that program). Thirty-five Head Start preschool classrooms in six centers were randomly assigned to one of the aforementioned programs or the control condition. A total of 507 *Head Start* children participated in the study, during one of the following school years, 2001-2002, 2002-2003, or 2003-2004. Forty-two per cent were African American, 41% Hispanic, and 7% White.

ANCOVAs indicated that both treatment groups generally outperformed the control group in emergent writing, book and print knowledge, and general reading readiness skills. Specifically, students in *Let's Begin with the Letter People* scored significantly higher than the control group on literacy measures for an average effect size of +0.20 but not on language (ES = + 0.06).

PCER (2008). *Let's Begin with the Letter People* was one of the curricula evaluated in the PCER project by the University of Texas Health Science Center at Houston along with *Doors to Discovery*. *Let's Begin* was compared to a control group that implemented teacher-developed, non-specific curricula in full-day Head Start and public prekindergarten programs in Texas. Forty-four teachers/classrooms and 297 parents and children (101 in *Doors to Discovery* treatment group, 100 in the *Let's Begin* treatment group, and 96 in the control group) were selected for inclusion in the study sample for the PCER project. The children were on average 4.6 years of age at the time of baseline data collection and more than half (55%) were male. The racial/ethnic composition of the sample of children was diverse: 43 percent Hispanic, 30 percent White, and 13 percent African American. No impacts on the preschool or kindergarten student-level outcomes were found. In preschool, effect sizes were slightly mixed, while in kindergarten they were slightly negative.

Across all studies, the average weighted effect size for *Let's Begin with the Letter People* on literacy outcomes at the end of preschool was +0.15 and on phonological awareness the effect size was +0.24, but these effects had faded by the end of kindergarten.

Literacy Express

Literacy Express is a preschool curriculum that is designed to promote children's emergent literacy skills. The curriculum is structured around thematic units that are sequenced in order of complexity. Each unit includes selected children's books that address theme-relevant vocabulary for small- and large-group reading activities. In addition, each thematic unit includes small-group activities, conducted three to four times a week, which provide homogeneous small groups of children with practice in the skills needed to develop oral language, phonological sensitivity, and print awareness. The large-group and extension activities provide opportunities for children to apply newly acquired skills in varied contexts.

PCER (2008). As part of the PCER project, a Florida State University (FSU) research team evaluated two curricula: *Literacy Express* and *DLM Early Childhood Express supplemented with Open Court Reading Pre-K*. In this section, we report *Literacy Express* as compared to a control group, which implemented the *High/Scope* curriculum.

The FSU research team recruited two teachers from each of 16 full-day public prekindergarten programs to participate in the study. The final study sample included 30 teachers and classrooms across three conditions (nine control, 10 *Literacy Express*, and 11 *DLM Early Childhood Express supplemented with Open Court Reading Pre-K*). There were 297 children in the study (99 in the *Literacy Express* treatment group; 101 in the *DLM Early Childhood Express supplemented with Open Court Reading Pre-K* treatment group; and 97 in the control group). Data were collected on a total of 282 children at the time of the fall baseline data collection. The children were 4.6 years of age at baseline, with the majority of the sample of preschoolers African American (59%) or White (30%).

Non-significant literacy effects of +0.17 in pre-k faded to -0.01 in kindergarten, and there were kindergarten effects of +0.13 on language, +0.08 on phonological awareness, and -0.12 on math.

Montessori

Maria Montessori developed a program to educate the children in a housing development for poor families in Rome in the 19th century. She created many self-correcting materials designed to be used by individual children in prescribed ways to teach very specific concepts. She developed a program that emphasized teaching children responsibility through practical life skills and independent activities in a carefully planned environment (Roopnarine & Johnson, 1999).

A study by Karnes, Shwedel, & Williams (1983) compared five different programs: *Direct Instruction*; *Montessori*; a community integrated program, with a few low-income children integrated into middle class preschools; a traditional preschool; and the *Ameliorative Approach*, designed by Karnes. *The Ameliorative Approach* (later known as *GOAL for Games-Oriented Activities for Learning*) was a cognitive-developmental program designed to promote language and general cognitive development and enhance school-related motivation, and social, emotional, and motor development. It included structured and unstructured periods that encompassed language, math, science, social studies, art, and music activities.

The Louisville Experiment (1975). In an experiment in Louisville, Kentucky Miller and Dyer (1975) compared four different programs: two academic programs (*Direct Instruction* and *DARCEE*), *Montessori*, and traditional instruction. In 1968, 214 four-year-old children were randomly assigned to the four programs in Head Start classes in Louisville. There was a no-preschool control group that was excluded from our analyses because it was a non-equivalent, more advantaged group of children. Children attended classes daily from September 1968 to June 1969.

The short-term effects for Montessori were slightly negative, with an effect size on cognition at the end of preschool of -0.09 and at kindergarten of -0.11. The long-term effects were more positive and are described in the section on longitudinal studies.

Pre-K Mathematics Supplemented with DLM Early Childhood Express Math Software

PCER (2008). As part of the PCER project, researchers from the University of California, Berkeley, and the State University of New York at Buffalo implemented the *Pre-K Mathematics* curriculum supplemented with the *DLM Early Childhood Express Math software (Pre-K Mathematics with DLM)* in preschool classrooms in California and New York.

The *Pre-K Mathematics with DLM* curriculum consisted of 29 small-group mathematics activities with concrete manipulatives for use by teachers and children in preschool classrooms, as well as 19 home mathematics activities and materials, sent home every one to two weeks. The teacher's manual provided a curriculum plan that linked small-group classroom activities to home activities. Teachers conducted small-group mathematics activities twice per week with all prekindergarten children. Small-group activities involved groups of four to six children for approximately 20 minutes per group. In addition to these structured activities, similar mathematics materials and activities were available to children in classroom mathematics centers for use during free play.

The *DLM Early Childhood Express Math* software included 26 numerical, quantitative, geometric, and spatial activities. The software program provided individualized prekindergarten mathematics instructional activities for children to use approximately twice a week. Activities were scheduled such that children engaged in conceptually-related small-group, home, and computer mathematics activities during each week.

A research team from the University of California at Berkeley and SUNY Buffalo recruited five Head Start and public school prekindergarten programs in California and two Head Start and public school prekindergarten programs in New York. A total of 40 teachers/classrooms (20 in each state) were recruited from these Head Start and public school prekindergarten programs to participate in the study. Twenty-six (12 in California and 14 in New York) of the 40 classrooms were full-day prekindergarten programs. The children were 4.3 years of age at baseline and included African American (45%), Hispanic (23%), and White (18%) preschoolers. The racial/ethnic composition of the sample of children varied based on the geographic locations of the sample. The California sample was primarily African American (48%) or Hispanic (35%). A larger percentage of White children (36%) were represented in the New York sample. Eight children were randomly selected from each class to participate in the evaluation. One limiting factor of the study was that the teachers were instructed to focus the mathematics instruction on the focal children.

Several curricula were implemented in the control condition including *Creative Curriculum*, *High/Scope*, *Montessori*, specialized literacy curricula, and local school district and teacher-developed curricula. Sites were randomly assigned in the fall of the pilot study year by the research team, using block randomization to either the treatment condition (*Pre-K*

Mathematics with DLM) or the control condition. Blocks were formed at the program level (five programs in California and two in New York), with teachers from Head Start and state-funded programs balanced by curriculum assignment in each site.

One of the post-tests was the Shape Composition task, which is based on activities that were similar to those in the *DLM Early Childhood Express Math* software and thus inherent to the treatment, so it was not counted in the average of the mathematics measures. There was an unusual pattern of effects for the *Pre-K Mathematics with DLM* program. The effect sizes on mathematics and language in preschool (+0.33 and +0.17, respectively) dropped to +0.13 and +0.10 in kindergarten, while the modest effect for literacy (+0.11) increased to +0.19. Findings for the mathematics outcomes are also reported in Klein, Starkey, Clements, Sarama, and Iyer (2008).

Promoting Alternative Thinking Strategies (PATHS)

Spanning the social-emotional, behavioral, and cognitive skill domains, *Promoting Alternative Thinking Strategies (PATHS)* is a social-emotional curriculum, delivered in a developmentally-appropriate sequence. The curriculum emphasizes affective awareness of self and others, targeting children's ability to self-regulate their behavior.

Domitrovich et al. (2007) tested the effectiveness of PATHS for preschoolers in a randomized study. The first year of the three-year study was devoted to familiarizing intervention teachers with the PATHS curricular processes and materials. The following year, 20 classrooms within two Pennsylvania Head Start centers (246 children in total) were randomly assigned to 10 intervention and 10 control conditions. Demographically, the participant sample reflected the make-up of their Head Starts in terms of race, gender, and SES indicators. On pretest measures, intervention and control students performed similarly. Delivery of the treatment consisted of 30 lessons. At post-test, 201 students remained, due to 18% attrition over the school year. Several child outcomes were administered, but only one cognitive measure, the Leiter Sustained Attention scale, met the criteria for inclusion in this review. After one year, PATHS scored non-significantly higher than the controls on this measure, with an effect size of +0.16.

Project Approach

Project Approach is a set of teaching strategies that enables teachers to guide children through in-depth investigations of real world topics. The curriculum is designed to use children's interests as the starting point for organizing and developing classroom learning activities. Three curriculum components address children's learning needs: spontaneous play, systematic instruction, and project work. A *project* is defined as an in-depth study of a real world topic that is worthy of children's attention and effort. Projects can be incorporated into an existing classroom instructional program and can extend over several days or weeks. The structural features of *Project Approach* include discussion, fieldwork, representation, investigation, and display. During the preliminary planning stage, the teacher selects the topic of study (based primarily on classroom learning goals, children's interests, and the availability of local

resources). The teacher then brainstorms his or her own experience, knowledge, and ideas and represents them in a topic web. This topic web is revised throughout the project and used for recording progress. In *Project Approach* classrooms, the daily schedule is structured so that children and teachers spend at least 45 to 60 minutes engaged in investigation and discovery, typically in small groups.

PCER (2008). As part of the PCER project, researchers at Purdue University and the University of Wisconsin-Milwaukee implemented the *Project Approach* curriculum. The Purdue/Wisconsin research team recruited public prekindergarten classrooms for participation in the study. The research team recruited 13 teachers from 12 different schools. A sample of 204 children (114 treatment, 90 control) and parents were recruited for participation in the study. Data were collected on 204 children and 176 parents at the time of the baseline data collection. The children were 4.6 years of age at the baseline data collection, and the racial/ethnic composition of the sample was diverse: African American (40%), White (28%), and Hispanic (17%).

The Purdue/Wisconsin research team randomly assigned 13 teachers and their classes to the experimental conditions (seven treatment and six control classrooms). The *Project Approach* curriculum was implemented in public prekindergarten classrooms in Wisconsin. In the control classrooms, teachers reported implementing their own teacher-developed, nonspecific curricula.

At the end of kindergarten there were non-significant effects on language (ES = +0.21), and mathematics (ES = +0.24) effects were slightly higher than in kindergarten than in prekindergarten, but the literacy scores dropped from an effect size in prekindergarten of +0.28 to +0.15 and the phonological awareness scores in kindergarten produced a negative effect size (-0.17).

Project Construct

Project Construct was developed under the direction of the Missouri Department of Elementary and Secondary Education in 1986 to fulfill the need for a curriculum and assessment framework that supports children's learning. *Project Construct* is derived from constructivism—the theoretical view that learners construct knowledge through interactions with the physical and social environments. The preschool curriculum, the *Early Childhood Framework for Curriculum and Assessment*, was first published in 1992 by the Project Construct National Center, and was revised in 2002. The *Project Construct* approach is organized around 29 goals for students that are set within a context of four developmental domains: cognitive, representational, sociomoral, and physical. The Project Construct National Center supports professional development through institutes, workshops, conferences, and on-site consultations as well as through extensive print and video materials.

PCER (2008). For the PCER project, the University of Missouri (Missouri) research team evaluated the *Project Construct* 2002 revised curriculum. The Missouri researchers recruited 21 full-day child-care centers, and the external evaluators grouped schools into blocks of two based on characteristics such as teachers' experience, school location, or score on a state

report card system, and randomly assigned half the schools in each block to the treatment group and half to the control group. The treatment classrooms received training, supplies, and materials to support the implementation of *Project Construct*. In the control schools, teacher-developed generic curricula were implemented.

A total of 231 children were recruited. Data were collected on a total sample of 188 children at the time of the fall baseline data collection. The children were 4.7 years old at the time of baseline data collection and the majority of the sample of preschoolers was White (65%) or African American (29%).

No significant impacts on the preschool or kindergarten child outcomes were found, with effect sizes in the spring of kindergarten ranging from -0.06 for CMA-A Mathematics Composite to +0.16 for WJ Letter Word Identification.

Ready, Set, Leap!

Ready, Set, Leap! is a comprehensive preschool curriculum, published by LeapFrog SchoolHouse, which combines literacy-focused instructional approaches with multisensory technology. The curriculum is structured around nine thematic units, each with detailed lesson plans for large- and small-group instruction, and ongoing assessment tools. The program stresses the importance of experiential learning, social and emotional development, teacher-child relationships, and home-school connections. The curriculum includes language and early literacy, mathematics, science, social studies, fine arts, health and safety, personal and social development, physical development, and technology applications. The language and literacy component emphasizes phonological awareness, alphabetic knowledge, print awareness, oral language development, reading aloud, and reading comprehension through story discussion. The technology is designed to provide thematic center-based activities that provide individualized feedback to students. There is also a component to encourage parent-child interactions and to forge strong home-school connections.

PCER (2008). For the PCER project, the University of California, Berkeley researchers, in collaboration with RMC Research, implemented *Ready, Set, Leap!* The research team recruited 21 full-day prekindergarten programs in New Jersey. The children were 4.5 years of age at the time of baseline data collection and the majority of the preschoolers were African American (78%) or Hispanic (20%). In the control condition, teachers used the *High/Scope* approach. The external evaluators grouped schools into blocks of two based on characteristics such as teachers' experience, school location, and score on a state report card system, and randomly assigned half the schools in each block to the treatment group and half to the control group. No significant impacts on the prekindergarten or kindergarten child outcomes were found, and all kindergarten effect sizes were essentially zero.

RMC (2003). A randomized study of *Ready, Set, Leap!* (*RSL*) was carried out in 17 high poverty, inner-city Newark public elementary schools by RMC Research Corporation (RMC, 2003). Schools were randomly assigned to either *RSL* or a control group. Treatment (N=129) and control groups (N=125) were comparable in terms of their initial pretest scores and other

characteristics. All children were pretested in fall, 2002, and post-tested in spring, 2003. On average, 44% of students were African American, 37% Hispanic, and 15% Caucasian. A two-level hierarchical linear analysis with pretests as covariates found small to moderate but non-significant effects on five of the post-test measures, with a mean effect size of +0.18 for literacy measures and +0.10 for language measures.

Abt Associates (2007) examined the impacts of three intervention programs on teacher behaviors, classroom environments, and child outcomes—*Ready, Set, Leap! Building Early Language and Literacy (BELL)*, and *Breakthrough to Literacy (BTL)*--in an 18-month study in Miami-Dade County, Florida. See the BTL section above for details of the method. Children in the *Ready, Set, Leap!* group scored significantly higher than control group students on all four subscales of the Test of Preschool Emergent Literacy (TOPEL): Definitional Vocabulary (ES = +0.28), Phonological Awareness (ES = +0.35), Print Knowledge (ES = +0.65), and Early Literacy Index (ES = +0.51).

Across the three studies of *Ready, Set, Leap!*, the weighted mean effect size was +0.24 for literacy outcomes and +0.18 for phonological awareness.

Research-based Developmentally Informed (REDI) Program

REDI (Research-based, Developmentally Informed) is an enrichment program that was integrated into regular Head Start centers that use *High/Scope* or *Creative Curriculum*. This program is designed to promote academic and social-emotional school readiness to preschoolers by training teachers using program-based strategies and techniques in their classrooms that combined *Preschool PATHS* and *Dialogic Reading* (Whitehurst, Arnold et al., 1994), a set of “Sound Games” (Adams et al., 1998), and print center activities, for emergent literacy skills. Teachers received a three-day intensive training prior to the intervention and a one-day follow-up training four months after the intervention. In addition, teachers received weekly mentoring support provided by *REDI* trainers. Parents were also provided with materials for home activities with their children.

Bierman et al. (2008) recruited two cohorts of four-year-olds over two years to participate in a study. Participants were 356 preschoolers from 44 Head Start classrooms in three counties in Pennsylvania. A stratified random sampling using length of program, location, and demographics was used. To account for the nested nature of the data (i.e., students nested within classrooms), hierarchical linear models were employed to estimate the intervention effect. Significant treatment effects in pre-k were detected on language (ES = +0.18), literacy (ES = +0.16), and phonological awareness (ES = +0.43).

Sound Foundations

Sound Foundations is a phonemic awareness program developed in Australia by Byrne and Fielding-Barnsley (1991). The focus of the program is on recognition of phoneme identity across words with special attention paid to nine key phonemes. Large pictorial posters with words using these key phonemes are used in the class to help children learn them. Children are

trained in small groups of four to six in a weekly 25-30 minute lesson. In each lesson, the teacher introduces one phoneme and children are then asked to identify words associated with that phoneme on the poster. After children master these key phonemes, they are introduced to worksheets and game cards to facilitate further learning. This program is no longer available for distribution.

Byrne & Fielding-Barnsley (1991, 1995) conducted an experimental study with 128 children from four preschools in Australia to examine the efficacy of *Sound Foundations*. Children were randomly assigned to treatment and control groups. The treatment group received phoneme training in a small group of four to six for 12 weeks; the controls were also trained in reading in a small group of four to six but did not receive phoneme training. At post-test, the treatment children scored significantly higher than controls on a word-choice test (ES = +1.53), and untrained phoneme identity scores (ES = +0.19). At the end of kindergarten the mean effect size was +0.21 on five literacy measures, and these effects continued into second grade.

Tools of the Mind

Tools of the Mind is a curriculum for three- to four-year-olds based on Vygotsky's theories. It focuses on children's ability to self-regulate, oral language, phonemic awareness, letter knowledge, conventions of print, and early math skills. The activities emphasize children planning their activities, dramatic play, use of self-regulatory private speech, and use of external aids to facilitate memory and attention. Children learn in structured play, doing partner reading and writing activities, dance, and games.

Barnett and his colleagues (2008) carried out a randomized evaluation of *Tools of the Mind* in an urban New Jersey school district. More than 92% of children were Latino and 70% had Spanish as their primary home language. Children and teachers were randomly assigned to use *Tools of the Mind* (N=7 teachers, 88 children) or a control condition (N=12 teachers, 122 children) in which children experienced a district-created "balanced literacy" method. The focus of the two curricula was described as being equal with regard to literacy, but there was more emphasis in the control condition on teacher direction and less on the development of self-regulation skills. All classes used full-day (6hrs/day) programs.

Children were pre-and post-tested as individuals. Some measures were given in Spanish to Spanish-dominant children. Adjusting for pretests, there were non-significant effects with effect sizes for language (ES = +0.17), cognition (ES = +0.06), math (ES = +0.15), and literacy (ES = -0.03) outcomes.

Waterford Early Reading Program

The *Waterford Early Reading Program (Waterford)* is an ICT integrated learning system that provides 15 minutes of daily computerized one-to-one learning activities for preschool children. It focuses on teaching children their letters, as well as developing phonological and phonemic awareness, story and print concepts, and language concepts. It gives teachers information on children's levels of skill, which they are expected to use to provide appropriate

teaching outside of computer time. Developmentally appropriate books and videotapes are introduced in class and then sent home with children.

Fischel et al. (2007) carried out a randomized quasi-experimental evaluation of *Waterford* in six Head Start centers in south-eastern New York State. The children were four-year-olds, and were 42% African American, 41% Hispanic, 8% multiracial, and 7% White. Fourteen percent were Spanish-dominant. Combining across three cohorts (2001-2002, 2002-2003, and 2003-2004), a total of 12 classes (n=172) were randomly assigned to *Waterford* and 11 to control (n=150). An additional 12 classes (n=185) were randomly assigned to *Let's Begin with the Letter People*, described earlier in this report.

The centers had been using the *High/Scope* curriculum for 10 years, and all classes continued to do so, with the addition of the *Waterford* or *Let's Begin* activities in the experimental groups. Children were individually pre- and post-tested on eight measures. Adjusting for pretests, post-test effect sizes comparing *Waterford* to control were +0.32 for Get Ready to Read!, +0.06 for PPVT, +0.12 for FACES Letters Known, +0.11 for Woodcock Letter Word Identification, +0.02 for Woodcock Dictation, 0.00 for FACES Book Knowledge, +0.25 for FACES Print Conventions, and -0.21 for FACES Comprehension, for an overall mean of +0.08.

Studies of Long-Term Effects

There are a few longitudinal studies that follow up studies of programs that were evaluated initially in the 1960s and 1970s. This section summarizes the effects that those studies report on long-term educational and social adjustment outcomes.

The curricular models that were initially studied thirty or forty years ago have evolved and the current versions of those models may be quite different from those that were implemented in the initial evaluations. Further, standard preschool practices, social conditions, and such factors as access to television and other media have also changed, meaning that control groups today may be different from control groups 30-40 years ago. In fact, in some more recent evaluations, the interventions evaluated in these early studies are the control conditions. For these reasons, it cannot be assumed that these studies would have the same effects today. However, we report these longitudinal studies because they may indicate how differential treatments in preschool effect children's development over time.

The studies are described below and their findings are summarized in Table 3.

=====

TABLE 3

=====

High/Scope Curriculum Comparison Project. Weikart (1998) conducted a comparison of *High/Scope*, *Direct Instruction*, and a traditional nursery school starting in 1967. Sixty-eight

high poverty three- and four-year-olds participated in half-day classes conducted each weekday morning. Teachers made weekly home visits for an hour and a half. At the end of preschool, the *Direct Instruction* group significantly outperformed the nursery group on IQ ($ES = +0.66$). However, the IQ difference among the groups diminished over time. Upon follow-up at age 23, the *High/Scope* and nursery groups had a higher high school grade point average than the *Direct Instruction* group, fewer years in special education, and fewer failed grades (Schweinhart & Weikart, 1997). In addition, students who attended *High/Scope* and nursery programs were more likely to have attended college or vocational training. *High/Scope* and nursery attendance had an effect on delinquency and employment. A higher percentage of *High/Scope* and nursery participants were employed than in the *Direct Instruction* group. This study was excluded from the present review because of the small sample size in each condition and differing duration of exposure to the different programs.

Learning to Learn. Sprigle and Schaefer (1985) followed up a randomized evaluation of *Learning to Learn*, a cognitive-developmental program, in comparison to a standard Head Start program (Van de Riet & Resnick, 1973). Ninety four- and five-year-old African American children participated in either three years of compensatory education from preschool to first grade, or two years from kindergarten to first grade.

Statistically significant short-term effects on intelligence, achievement, and creativity favored the *Learning to Learn* participants. In the follow-up study, the *Learning to Learn* participants scored significantly higher in reading ($ES = +0.61$ and $+0.83$), and sixth grade differences were positive but not statistically significant ($ES = +0.51$). The most striking differences were for special education placements and grade retention ($ES = +0.57$ and $ES = +0.62$, respectively). However, these effects were not influenced by the number of years of participation in the program. Children who started the program in kindergarten achieved at the same level as those who began in preschool.

The Louisville Experiment. Miller and Dyer (1975) compared four different programs: two academic programs (*Direct Instruction* and *DARCEE*) and one cognitive-developmental program (*Montessori*), to a traditional control group. In 1968, two hundred and fourteen four-year-old children were randomly assigned to the four programs in Head Start classes in Louisville. There was a no-preschool control group that was excluded from our analyses because it had a non-equivalent, more advantaged group of children. Children attended classes daily from September 1968 to June 1969. About one quarter of the children attended a token economy Follow Through kindergarten program.

The children were tested each spring through second grade on measures of IQ, achievement, curiosity, persistence, inventiveness, and classroom behavior. They were followed up in seventh to twelfth grade as part of the Consortium for Longitudinal Studies project. Generally, immediate small positive effects for *Direct Instruction* on cognitive skills faded, while the positive effects for *Montessori* increased over time, particularly for boys (Miller & Bizzell, 1984).

Karnes, Shwedel, and Williams (1983) compared five different programs: *Direct Instruction*; *Montessori*; a community integrated program, with a few low-income children integrated into middle class preschools; a traditional preschool; and the *Ameliorative Approach*, designed by Karnes. The *Ameliorative Approach* (later known as *GOAL* for Games-Oriented Activities for Learning) was a cognitive-developmental program designed to promote language and general cognitive development and school-related motivation, and to enhance social, emotional, and motor development.

The findings of this study were confounded by unequal duration of treatments. There were two cohorts. Only the 1965 cohort had a traditional condition and only the 1966 cohort had the community-integrated program. The *Direct Instruction* program continued through kindergarten and the *Ameliorative Approach* received an hour daily of additional training in kindergarten. We excluded this study from the review because these duration differences make the comparisons difficult to interpret.

Overall, the long-term results of these few longitudinal studies indicate that cognitive developmental programs have better long-term outcomes than solely academic programs.

Summarizing Evidence of Effectiveness for Programs

It is useful to have summaries of the strength of the evidence supporting effects for programs educators might select to improve students' outcomes. The following early childhood programs were rated as follows.

Strong Evidence of Effectiveness

Six early childhood programs produced strong evidence of effectiveness, with a sample size-weighted effect size of at least +0.20 in at least two studies, at least one of which was randomized:

Curiosity Corner

Direct Instruction

ELLM

Interactive Book Reading

Let's Begin with the Letter People

Ready Set Leap!

The effects for these programs were on language, literacy and/or phonological awareness. For some of the studies the meaningful effects were seen at the end of preschool (*Direct Instruction*, *Interactive Book Reading*), for others at the end of kindergarten (*Curiosity Corner*, *ELLM*, *Ready Set Leap!*).

Moderate Evidence of Effectiveness

Five programs had at least one randomized or two matched studies and a weighted mean effect size of at least +0.20

Breakthrough to Literacy
Bright Beginnings
DLM Express plus Open Court
PreK Mathematics Plus DLM Software
Project Approach

Limited Evidence of Effectiveness: Strong Evidence of Modest Effects

Three programs met the criteria for ‘moderate evidence of effectiveness’ with weighted mean effect sizes between +0.10 and +0.19 on one or more outcome clusters.

Doors to Discovery
Language Focused Curriculum
Literacy Express

Limited Evidence of Effectiveness: Weak Evidence with Notable Effects

Three programs had a weighted mean effect size of at least +0.20, but did not qualify for ‘moderate evidence of effectiveness’ due to insufficient numbers of students.

EMERGE
PATHS
Sound Foundations

Insufficient Evidence of Effectiveness

Studies of the following programs did not meet the criteria for ‘limited evidence of effectiveness.’

BELL
Creative Curriculum
DARCEE
Dialogic Reading
Ladders to Literacy
Montessori
Project Construct
REDI
Tools of the Mind
Waterford

N No Qualifying Studies

These programs did not have any qualifying studies.

Abecedarian

Building Blocks

Early Authors Program

High/Scope

Reggio Emilia

Scholastic Preschool Program

Discussion

The findings of this systematic review are consistent with the common-sense expectation that children learn what they are taught. The programs focusing on mathematics instruction generally improved mathematics achievement; those focusing on literacy and phonological awareness increased those skills. These outcomes may merely indicate that teaching preschool children skills ordinarily emphasized in kindergarten or later produce immediate effects on those skills. However, several programs showed positive effects continuing to the end of kindergarten and beyond, suggesting that the preschool experience had impacts not limited to early exposure to academic content. Also, several programs had effects on oral language skills, which are emphasized in most preschools.

Of the 27 programs evaluated, six showed strong evidence of effectiveness and five had moderate evidence of effectiveness. Interestingly, averaging across all included studies of the interventions, there were small effects at the end of preschool for all outcomes – language (ES = +0.11), literacy (ES = +0.15), phonological awareness (ES = +0.15), mathematics (ES = +0.17), and cognition (ES = +0.13). While there is a long way to go in determining exactly what constitutes the most effective forms of early childhood programs for improving the outcomes for children at risk due to poverty, the increasing number and quality of the studies on early childhood programs is heading the field in the right direction.

The findings from the end of preschool or kindergarten for the recent studies reported should be interpreted with some caution based on the long-term effects of programs from the 1960s and 70s, which found that the short-term effects of more academic programs wore off after a few years in elementary school and that the longitudinal effects on educational and social adjustment outcomes, such as reduced delinquency, teenage pregnancy and higher employment, were found for cognitive developmental programs. Hopefully, additional longitudinal studies will be conducted to determine the long-term impacts of the current programs, most of which combine elements of academic instruction with more child-initiated activities.

Aspects of both cognitive developmental and academic approaches have benefits that can inform the creation of comprehensive preschool programs. Academic approaches generally have clearly defined, specific objectives. It is easier for teachers to monitor the progress of children if

they have a clear idea of what they are working toward. They then provide carefully planned experiences designed to move children toward success on academic outcomes, and this gives the children a significant advantage as they enter elementary school. At the same time, the cognitive-developmental approach emphasizes the importance of giving children choices and fostering their autonomy and self-regulation, scaffolding children's development by providing the foundational knowledge in an interactive, constructivist way.

Beyond the curricular emphasis, another factor that differentiates programs is the degree of support that the teachers are provided in implementing the curriculum. In most of the studies reported here, teachers received more support for implementation of the program than teachers typically receive when implementing a new program. In practice, teachers often receive very little support, perhaps just a teacher's manual with suggested activities. In some of the research studies summarized here, they received extensive initial training and very frequent follow-up coaching by the developer or researchers, which may not be typical when the program is implemented at scale. There are two lessons in this. First, it usually takes ongoing support for teachers to learn to implement the innovative forms of instruction that new programs require. Educational administrators need to plan and budget for this when adopting new programs.

Second, researchers need to conduct research on educational programs as they are implemented at scale, without the additional support often provided in research. In larger scale investigations of different curricula, it is important for researchers to observe and describe what actually happens in both treatment and comparison conditions. Assessments of fidelity of implementation might help explain the impacts, or lack thereof, in some studies. Many of the studies that were reviewed for this article lacked sufficient description of both conditions, particularly the comparison condition.

The findings of this review add to a growing body of evidence that early childhood programs can have an important impact on increasing the school readiness of young children. There is a tremendous need for systematic, large-scale, longitudinal, randomized evaluations of the effectiveness of preschool interventions in bringing children from high-risk environments to normative levels of academic achievement. However, this review identifies several promising approaches that could be used today to help children begin elementary school ready to succeed.

References

- Abt Associates, Inc. (2007, March). *Findings from Project Upgrade in Miami-Dade County*. Cambridge, MA.
- Assel, M., Landry, S., Swank, P., & Gunnewig, S. (2007). An evaluation of curriculum, setting, and mentoring on the performance of children enrolled in prekindergarten. *Reading and Writing, 20*(5), 463-494.
- Barnett, W.S. (2007). Benefits and costs of quality early childhood education. *Legal Rights Journal, 27*(1), 7-23.
- Barnett, W. S., Frede, E. C., Mosbasher, H., & Mohr, P. (1987). The efficacy of public preschool programs and their relationship of program quality to efficacy. *Educational Evaluation and Policy Analysis, 10*(1), 37-49.
- Barnett, W. S., Jung, K., Yarosz, D. J., Thomas, J., Hornbeck, A., Stechuk, R. Burns, S. (2008). Educational effects of Tools of the Mind curriculum: A randomized trial. *Early Childhood Research Quarterly, 23*(3), 299-313.
- Belsky, J. & Melhuish, E. (2007). Impact of Sure Start Local Programmes on children and families. In J. Belsky, J. Barnes, & E. Melhuish, (Eds.). *The National Evaluation of Sure Start: Does Area-Based Early Intervention Work?* (pp. 133-154). Bristol, UK: The Policy Press.
- Berrueta-Clement, J., Barnett, W., Schweinhart, L., Epstein, A., & Weikart, D. (1984). *Changed lives: The effects of the Perry Preschool Program on youths through age 19* (Monograph of the High/Scope Educational Research Foundation No. 8). Ypsilanti, MI: High/Scope Press.
- Bierman, K. L. (2008). Promoting Academic and Social-Emotional School Readiness. In C. E. Domitrovich, R. L. Nix, S. D. Gest, J. A. Welsh, M. T. Greenberg, C. Blair, K. E. Nelson & S. Gill (Eds.), *The Head Start REDI Program, 79*, 1802-1817.
- Bowman, B. T., Donovan, M. S., & Burns, M. (Eds.). (2001). *Eager to learn: Educating our preschoolers*. Washington, DC: National Research Council.
- Bryant, D. M., & Ramey, C. T. (1987). An analysis of the effectiveness of early intervention programs for environmentally at-risk children. In M. J. Guralnick & F. C. Bennett (Eds.), *The effectiveness of early intervention for at-risk and handicapped children* (pp 33-78). Chapel Hill, NC: Academic Press.
- Byrne, B. & Fielding-Barnsley, R. (1993). Evaluation of a program to teach phonemic awareness to young children: A 1-year follow-up. *Journal of Educational Psychology, 85*(1), 104-111.

- Camilli, G., Vargas, S., Ryan, S., & Barnett, S. (2010). Meta-analysis of the effects of early education interventions on cognitive and social development. *Teachers College Record*, 112(3), <http://www.tcrecord.org> ID Numbers: 15440.
- Campbell, F. A., & Ramey, C. T. (1995). Cognitive and school outcomes for high-risk African American students at middle adolescence: Positive effects of early intervention. *American Education Research Journal*, 32, 743-772.
- Chambers, B., Chamberlain, A., Hurley, E., & Slavin, R. (2001, April). *Curiosity Corner: Enhancing preschoolers' language through comprehensive reform*. Paper presented at the annual meeting of the American Educational Research Association, Seattle, WA.
- Chambers, B., Cheung, A., Slavin, R.E. (2006). Effective preschool programs for children at risk of school failure: A best-evidence synthesis. In B. Spodek (Ed.). *Handbook of research on the education of young children*. (pp. 347-360). New York: Lawrence Erlbaum.
- Cheung, A., & Slavin, R.E. (2005). Effective reading programs for English language learners and other language minority students. *Bilingual Research Journal*, 29 (2), 241-267.
- Coghlan, M., Bergeron, C., White, K., Sharp, C., Morris, M., Rutt, S. (2009). *Narrowing the gap in outcomes for young children through effective practices in the early years*. Center for Excellence and Outcomes in Children and Young People's Services, London, UK.
- Cooper, H. (1998). *Synthesizing research (3rd ed.)*. Thousand Oaks, CA: Sage.
- Cosgrove, M., Fountain, C., Wehry, S. et al. (2006, April). *Randomized field trial of an early literacy curriculum and instructional support system*. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.
- Currie, J. (2000). *Early childhood intervention programs: What do we know?* Chicago: Joint Center for Poverty Research. Hillsdale, NJ: Lawrence Erlbaum.
- Darrow, C. L. (2009, March). *Language and literacy effects of curriculum interventions for preschools serving economically disadvantaged children: A meta-analysis*. Paper presented at the annual meeting of the Society for Research on Educational Effectiveness, Alexandria, Virginia.
- Domitrovich, C. E., Cortes, R.C., & Greenberg, M.T. (2007). Improving young children's social and emotional competence: A randomized trial of the preschool "PATHS" curriculum. *The Journal of Primary Prevention*, 28(2), 67-91.
- Engelmann, S. (1968). The Effectiveness of Direct Instruction on IQ Performance and Achievement in Reading and Arithmetic. In J. Hellmuth (Ed.), *Disadvantaged Child* (vol. 3). New York: Brunner/Mazel.

- Evans, E. D. (1985). Longitudinal follow-up assessment of differential preschool experience for low-income minority group children. *Journal of Educational Research*, 78, 197-202.
- Fischel, J. E., Bracken, S. S., Fuchs-Eisenberg, A., Spira, E. G., Katz, S., & Shaller, G. (2007). Evaluation of curricular approaches to enhance preschool early literacy skills. *Journal of Literacy Research*, 39(4), 471.
- Gettinger, M. & Stoiber, K. (2007). Applying a response-to-intervention model for early literacy development in low-income children. *Topics in Early Childhood Special Education*, 27(4), 198-213.
- Gilliam, W. S., & Zigler, E. F. (2000). A critical meta-analysis of all evaluations of state funded preschool from 1977 to 1998: Implications for policy, service delivery and program evaluations. *Early Childhood Research Quarterly*, 15, 441-473.
- Gorey, K. M. (2001). Early childhood education: A meta-analytic affirmation of the short- and long-term benefits of educational opportunity. *School Psychology Quarterly*, 16, 9-30.
- Gray, S. W., Klaus, R. A., Miller, J. O., & Forrester, B. J. (1966). *Before first grade*. New York: Teachers College Press.
- Karnes, M B., Shwedel, A. M., & Williams M. B. (1983). A comparison of five approaches for educating young children from low-income homes. In The Consortium for Longitudinal Studies, *As the twig is bent...Lasting effects of preschool programs*. (pp 133-170). Hillsdale, NJ: Lawrence Erlbaum.
- Karoly L. A., Greenwood, P. W., Everingham, S. S., Hoube, J., Kilburn, M. R., Rydell, C. P., et al. (1998). *Investing in our children: What we know and don't know about the costs and benefits of early childhood interventions*. Santa Monica, CA: RAND.
- Karweit, N. (1993). Effective preschool and kindergarten programs for students at risk. In B. Spodek (Ed.), *Handbook of Research on the Education of Young Children* (pp 385-411). New York: Macmillan Publishing Company.
- Lipsey, M. W., & Wilson, D. B. (2001). *Practical meta-analysis*. Thousand Oaks, CA: Sage.
- Magnuson, K., Meyers, M., Ruhm, C., & Waldfogel, J. (2003). *Inequality in preschool education and school readiness*. New York: Columbia University.
- Miller, L.B. & Bizzell, R.P. (1984). Long-term effects of four preschool programs: Ninth- and tenth-grade results. *Child Development*, 55, 1570-1587.
- Miller, L. B., Dyer, J. L. (1975). Four preschool programs: Their dimensions and effects, *Monographs of the Society for Research in Child Development*, 40(5-6), Serial No.162.

- National Research Council and Institute of Medicine (2000). *From neurons to neighborhoods: The science of early childhood development*. Washington, DC: National Academy Press.
- Neuman, S. B., Copple, C., & Bredekamp, S. (1999). *Learning to read and write: Developmentally appropriate practices for young children*. Washington, DC: National Association for the Education of Young Children.
- Penn, H., Burton, B, Lloyd, E., Potter, S., Sayeed, Z., & Mugford, M. (2006). What is known about the long-term economic impact of center-based early childhood interventions? Technical Report, In: *Research Evidence in Education Library*. London: ERRI-Center, Social Science Research Unit, Institute of Education, University of London.
- Preschool Curriculum Evaluation Research Consortium (2008). *Effects of preschool curriculum programs on school readiness* (NCER 2008-2009). Washington, DC: National Center for Education Research, Institute of Education Sciences, U.S. Department of Education. Washington, DC: U.S. Government Printing Office.
- Ramey, C. T., & Ramsey, S. L. (1998). Early intervention and early experience. *American Psychologist*, 53 (2), 109-120.
- Reynolds, A. J. (1995). One year of preschool intervention or two: Does it matter? *Early Childhood Research Quarterly*, 10, 1-31.
- Reynolds, A. J. (1994). Effects of a preschool plus follow-on intervention for children at risk, *Developmental Psychology*, 30(6), 787-804.
- Reynolds, A. J., Temple, J. A., Robertson, D. L., & Mann, E. A. (2001). Long-term effects of an early childhood intervention on educational achievement and juvenile arrest: A 15-year follow-up of low-income children in public schools. *Journal of the American Medical Association*, 285(18), 2339-2346.
- Roopnarine, J. L., & Johnson, J. E. (1999). *Approaches to early childhood education*. New York: Merrill.
- Rothstein, H.R., Sutton, A.J., & Borenstein, M. (Eds.) (2005). *Publication bias in meta-analysis: Prevention assessment, and adjustments*. Chichester, UK: John Wiley.
- Salaway, J. L. (2008). *Efficacy of a direct instruction approach to promote early learning*. Unpublished Ph.D. dissertation., Duquesne University.
- Schweinhart, L. J., Barnes, H. V., & Weikart, D. P. with Barnett, W. S., & Epstein, A. S. (1993). *Significant benefits: The High/Scope Perry Preschool study through age 27* (Monographs of the High/Scope Educational Research Foundation No. 10) Ypsilanti, MI: High/Scope Press.

- Sedlmeier, P., & Gigerenzer, G. (1989). Do studies of statistical power have an effect on the power of studies? *Psychological Bulletin*, *105*, 309-316.
- Shadish, W.R., Cook, T.D., & Campbell, D.T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston: Houghton-Mifflin.
- Slavin, R.E. (1986). Best-evidence synthesis: An alternative to meta-analytic and traditional reviews. *Educational Researcher*, *15* (9), 5-11.
- Slavin, R. E. (2008). What works? Issues in synthesizing education program evaluations. *Educational Researcher*, *37* (1), 5-14.
- Slavin, R.E., Cheung, A., Groff, C., & Lake, C. (2008). Effective reading programs for middle and high schools: A best evidence synthesis. *Reading Research Quarterly*, *43* (3), 290-322.
- Slavin, R., & Lake, C. (2008). Effective programs in elementary mathematics; A best-evidence synthesis. *Review of Educational Research*, *78* (3), 427-515.
- Slavin, R.E., & Madden, N. A. (in press). Measures inherent to treatments in systematic reviews in education. *Journal of Research on Educational Effectiveness*.
- Slavin, R.E., & Smith, D. (2009). The relationship between sample sizes and effect sizes in systematic reviews in education. *Educational Evaluation and Policy Analysis*, *31* (4), 500-506.
- Schweinhart, L. J., & Weikart, D. P. (1997). *Lasting differences: The High/Scope Preschool curriculum comparison study through age 23* (Monographs of the High/Scope Educational Research Foundation No. 12) Ypsilanti, MI: High/Scope Press.
- Klein, A., Starkey, P., Clements, D., Sarama, J., & Iyer, R. (2008). Effects of a pre-kindergarten mathematics intervention: A randomized experiment. *Journal of Research on Educational Effectiveness*, *1*, 155-178.
- Wasik, B. A. & Bond, M. A. (2001). Beyond the pages of a book: Interactive book reading and language development in preschool classrooms. *Journal of Educational Psychology*, *93*(2), 243-250.
- Wasik, B. A., Bond, M. A., & Hindman, A. (2006). The effects of a language and literacy intervention on Head Start children and teachers. *Journal of Educational Psychology*, *98*(1), 63-74.
- Whitehurst, G. J., Epstein, J. N., Angell, A.C., Payne, A.C., Crone, D.A., & Fischel, J.E. (1994). Outcomes of an emergent literacy intervention in Head Start. *Journal of Educational Psychology*, *86*, 542-555.
- Whitehurst, G. J., Zevenbergen, A. A., Crone, D. A., Schultz, M. D., Velting, O. N., & Fischel, J. E. (1999). Outcomes of an emergent literacy intervention from Head Start through second grade. *Journal of Educational Psychology*, *91*(2), 261-272.

Xue, Y., & Meisles, S. J., (2004). Early literacy instruction and learning in kindergarten: Evidence from the early childhood longitudinal study- kindergarten class of 1998-1999. *American Educational Research Journal*, 41, 191-229.

Yoshikawa, H. (1995). Long-term effects of early childhood programs on social outcomes and delinquency. *The Future of Children*, 5(3) 51-75.

TABLE 1 - Outcomes for Included Studies										
Study	Design	Duration	N	Sample Characteristics	Posttest	Preschool ES	Preschool Mean ES	Kinder ES	Kinder Mean	
Breakthrough to Literacy										
Abt Associates (2007)	Randomized	18 months	863 students (354E, 509C)	162 child care centers in Miami-Dade County that served children from low-income families. 57% Hispanic, 24% White, and 19% African American	Literacy					
					Early Literacy Index			+0.54	+0.48	
					Print knowledge			+0.60		
					Definitional Vocabulary			+0.31		
					Phonological Awareness					
Phonological Awareness			+0.44	+0.44						
Bright Beginnings										
PCER (2008)	Randomized	2 years	14 classes 208 students (103E, 105C)	Seven school districts in six counties in TN; 80% White, 18% African American, 11% Hispanic	Literacy					
					TERA	+0.39	+0.31	-0.07	+0.03	
					WJ Letter Word ID	+0.35		+0.09		
					WJ Spelling	+0.18		+0.06		
					Language					
					PPVT	+0.13	+0.11	+0.07	+0.12	
					TOLD	+0.09		+0.16		
					Phonological Awareness					
					Pre-CTOPP/CTOPP	-0.07	-0.07	+0.01	+0.01	
					Mathematics					
					WJ Applied problems	+0.16	+0.06	+0.13	+0.12	
CMA-A Math composition	+0.14	+0.07								
Shape composition	-0.03	+0.15								

Study	Design	Duration	N	Sample Characteristics	Posttest	Preschool ES	Preschool Mean ES	Kinder ES
Pre-K Mathematics plus DLM Early Childhood Express								
PCER (2008)	Randomized	2 years	40 classes 316 students (159E, 157C)	Head Start and public preschool programs in CA and NY; 18% White, 45% African American, 23% Hispanic, 13% others	Literacy			
					TERA	+0.13	+0.11	+0.31
					WJ Letter Word ID	-0.01		+0.22
					WJ Spelling	+0.20		+0.03
					Language			
					PPVT	+0.17	+0.17	+0.11
					TOLD	+0.17		+0.08
					Phonological Awareness			
					Pre-CTOPP/CTOPP	+0.04	+0.04	-0.11
					Mathematics			
WJ Applied problems	+0.22	+0.22	+0.13					
Building Early Language and Literacy (BELL)								
Abt Associates (2007)	Randomized	18 months	849 students (340E, 509C)	162 child care centers in Miami-Dade County Florida that served children from low-income families. 57% Hispanic, 24% White, and 19% African American	Literacy			
					Early Literacy Index			+0.06
					Print knowledge			+0.07
					Definitional Vocabulary			+0.07
					Phonological Awareness			
Phonological Awareness			+0.04					

Study	Design	Duration	N	Sample Characteristics	Posttest	Preschool ES	Preschool Mean ES	Kinder ES	Kinder Mean	
Creative Curriculum										
PCER (2008) (Tennessee)	Randomized	2 years	14 classes 206 students (101E, 105C)	Seven school districts in six counties in TN; 80% White, 18% African American, 11% Hispanic	Literacy					
					TERA	+0.02	+0.12	+0.10	+0.24	
					WJ Letter Word ID	+0.16		+0.38		
					WJ Spelling	+0.19		+0.25		
					Language					
					PPVT	+0.23	+0.15	+0.12	+0.12	
					TOLD	+0.07		+0.11		
					Phonological Awareness					
					Pre-CTOPP/CTOPP	+0.10	+0.10	+0.06	+0.06	
					Mathematics					
					WJ Applied problems	+0.17	+0.13	+0.17	+0.07	
CMA-A Math composition	+0.10	+0.05								
Shape composition	+0.12	0.00								
PCER (2008) (North Carolina and Georgia)	Randomized	2 years	18 classes 194 students (97E, 97C)	Head Start centers in NC and GA; 3% White, 85% African American, 8% Hispanic	Literacy					
					TERA	-0.08	-0.11	-0.04	-0.03	
					WJ Letter Word ID	-0.08		0.00		
					WJ Spelling	-0.18		-0.05		
					Language					
					PPVT	+0.08	-0.03	+0.15	-0.01	
					TOLD	-0.16		-0.17		
					Phonological Awareness					
					Pre-CTOPP/CTOPP	+0.02	+0.02	+0.06	+0.06	
					Mathematics					
					WJ Applied problems	+0.20	+0.10	+0.09	+0.07	
CMA-A Math composition	-0.10	+0.14								
Shape composition	+0.19	-0.01								

Study	Design	Duration	N	Sample Characteristics	Posttest	Preschool ES	Preschool Mean ES	Kinder ES	Kinder Mean	
Curiosity Corner										
PCER (2008)	Randomized	2 years	18 pre-K programs 225 students (105E, 110C)	Preschool programs in FL, KS, and NJ; 28% White, 51% African American, 14% Hispanic, and 8% others	Literacy					
					TERA	+0.10	+0.08	+0.43	+0.39	
					WJ Letter Word ID	+0.09		+0.43		
					WJ Spelling	+0.04		+0.20		
					Language					
					PPVT	-0.01	-0.05	+0.14	+0.15	
					TOLD	-0.08		+0.15		
					Phonological Awareness					
					Pre-CTOPP/CTOPP	+0.18	+0.18	+0.25	+0.25	
					Mathematics					
WJ Applied problems	+0.10	+0.09	+0.26	+0.18						
CMA-A Math composition	+0.01		-0.05							
Shape composition	+0.16		+0.32							
Chambers et al. (2001)	Matched control	1 yr	316 students (206E, 110C)	3 and 4-year-old children enrolled in child care centers and preschools in 4 high poverty urban school districts in New Jersey	Language					
					Expressive Language	+0.24	+0.15			
					Receptive Language	+0.06				
The Demonstration and Research Center for Early Education (DARCEE)										
Miller & Dyer (1975)	Randomized	1 yr	96 students (64E, 32C)	African American students with lowest SES in Louisville, KY	Cognitive (IQ)					
					End of preschool	-0.11	-0.11			
					Kindergarten			-0.11	-0.11	
Dialogic Reading										
Whitehurst et al. (1994)	Randomized	6 week intervention with follow-up at 6 months	70 students (46E, 24C)	Five day care centers in Suffolk County, New York. 22% White, 55% African American, and 23% Hispanic	Language					
					One Word	+0.13	-0.03			
					PPVT	-0.17				
					ITPA	-0.01				

Study	Design	Duration	N	Sample Characteristics	Posttest	Preschool ES	Preschool Mean ES	Kinder ES	Kinder Mean
Direct Instruction Miller & Dyer (1975)	Randomized	1 year	98 students (64E, 34C)	African American students with lowest SES in Louisville, KY	Cognitive (IQ)				
					End of preschool	+0.11	+0.11		
					Kindergarten			-0.02	-0.02
Salaway (2008)	Randomized	6 months	61 students (35E, 26C)	A preschool center in an urban, at risk community. 20% White, 69% African American, 2% Hispanic, and 10% others	Literacy				
					Initial Sounds Fluency	+0.75	+0.52		
					Letter Naming Fluency	+0.50			
					Letter and Word Skills	+0.32			
					Language				
					Expressive language	+0.40	+0.46		
					Receptive language	+0.51			
					Mathematics				
Number Skills	+0.37	+0.37							
Englemann (1968)	Matched control	2 yrs	43 students (15E, 28C)	Four-year old culturally disadvantaged children who were eligible for Head Start	Cognitive (IQ)				
					End of preschool	+0.66	+0.66		
					End of K			+1.34	+1.34
DLM Express plus Open Court									
PCER (2008)	Randomized	2 years	11 preschool programs 198 students (101E, 97C)	Public preschool programs in FL; 30% White, 59% African American, 6% Hispanic, 5% others	Literacy				
					TERA	+0.68	+0.55	+0.76	+0.49
					WJ Letter Word ID	+0.51		+0.50	
					WJ Spelling	+0.46		+0.22	
					Language				
					PPVT	+0.40	+0.40	+0.48	+0.47
					TOLD	+0.40		+0.46	

Study	Design	Duration	N	Sample Characteristics	Posttest	Preschool ES	Preschool Mean ES	Kinder ES	Kinder Mean
					Phonological Awareness				
					Pre-CTOPP/CTOPP	+0.32	+0.32	+0.38	+0.38
					Mathematics				
					WJ Applied problems	+0.36	+0.26	+0.48	+0.23
					CMA-A Math composition	+0.17		+0.13	
					Shape composition	+0.24		+0.09	
Doors to Discovery									
					Literacy				
					TERA	+0.06	+0.07	-0.05	-0.09
					WJ Letter Word ID	+0.10		-0.09	
					WJ Spelling	+0.06		-0.12	
					Language				
					PPVT	+0.15	+0.16	+0.18	+0.12
					TOLD	+0.17		+0.06	
					Phonological Awareness				
					Pre-CTOPP/CTOPP	+0.18	+0.18	-0.09	-0.09
					Mathematics				
					WJ Applied problems	+0.01	+0.00	-0.02	-0.10
					CMA-A Math composition	+0.13		-0.16	
					Shape composition	-0.13		-0.12	
					Language				
					PLS-IV	-0.20	-0.20		
					Expressive Vocabulary test	-0.20			
					Phonological Awareness				
					DSC auditory	+0.12	+0.12		
Early Literacy & Learning Model (ELLM)									
					Literacy				
					Reading Quotient	+0.28	+0.25		
					Alphabet	+0.28			
					Prints	+0.17			
					Meaning	+0.29			
					Alphabet Letter Recognition	+0.25			
					Literacy				

Study	Design	Duration	N	Sample Characteristics	Posttest	Preschool ES	Preschool Mean ES	Kinder ES	Kinder Mean
PCER (2008)	Randomized	1 yr	28 classes 244 students (137E, 107C)	Head Start, subsidized, faith based and preschool classrooms from 3 locations in FL; 14% White, 71% African American, 8% Hispanic, 6% others	TERA	+0.15	+0.07	+0.30	+0.11
					WJ Letter Word ID	-0.05		0.00	
					WJ Spelling	+0.11		+0.04	
					Language				
					PPVT	+0.17	+0.16	+0.34	+0.39
					TOLD	+0.15		+0.44	
					Phonological Awareness				
					Pre-CTOPP/CTOPP	+0.18	+0.18	+0.08	+0.08
					Mathematics				
					WJ Applied problems	+0.10	-0.01	+0.26	+0.08
CMA-A Math composition	+0.01	-0.05							
Shape composition	-0.14	+0.03							
EMERGE									
Gettinger & Stoiber (2007)	Matched control	1 year	342 students (188E, 154C)	Low SES Head Start and preschool centers in Milwaukee, Wisconsin, 90% African American	Literacy		+0.37		
					Alphabet Knowledge	+0.32			
					Story Telling	+0.40			
					Picture Naming	+0.63			
					Print Awareness	+0.49			
					Name Writing	-0.01			
					Language				
					PPVT	+0.13	+0.13		
					Phonological Awareness				
					Alliteration	+0.33	+0.28		
Rhyming	+0.23								
Interactive Book Reading									
Wasik & Bond (2001)	Randomized Quasi-Experiment	15 weeks	121 students	Title 1 early learning center in Baltimore, Maryland. 94% African American, 95% Free Lunch	Language		+1.33		
					PPVT III	+0.63			
					Receptive	+1.45			
					Expressive	+1.92			
Wasik, Bond, & Hindman (2006)	Randomized Quasi-Experiment	1 year	16 classes 207 students (139E, 68C)	2 Head Start centers in 2 Title I high-poverty Baltimore schools; 99% AA	Literacy		-0.33		
					Alphabet Knowledge	-0.33			
					Language				

Study	Design	Duration	N	Sample Characteristics	Posttest	Preschool ES	Preschool Mean ES	Kinder ES	Kinder Mean
					Receptive Language	+0.73	+0.59		
					Expressive Language	+0.44			
Ladders to Literacy									
PCER (2008)	Randomized	2 years	14 classes 123 students (62E, 61C)	Head Start centers in NH 38% White, 11% African American, 30% Hispanic, and 20% others	Literacy				
					TERA	-0.30	-0.05	-0.54	-0.30
					WJ Letter Word ID	-0.16		-0.27	
					WJ Spelling	+0.30		-0.08	
					Language				
					PPVT	-0.38	-0.30	-0.30	-0.18
					TOLD	-0.22		-0.06	
					Phonological Awareness				
					Pre-CTOPP/CTOPP	-0.16	-0.16	-0.10	-0.10
					Mathematics				
					WJ Applied problems	-0.14	+0.02	-0.33	-0.21
CMA-A Math composition	+0.18	-0.19							
Shape composition	+0.02	-0.10							
Language-Focused Curriculum									
PCER (2008)	Randomized	2 years	14 classes 195 students (97E, 98C)	Head Start and public preschool classrooms in VA; 71% White, 21% African American, 4% Hispanic, 3% others	Literacy				
					TERA	+0.16	+0.17	+0.05	+0.06
					WJ Letter Word ID	+0.11		+0.02	
					WJ Spelling	+0.25		+0.11	
					Language				
					PPVT	+0.02	+0.02	-0.09	-0.08
					TOLD	+0.01		-0.07	

Study	Design	Duration	N	Sample Characteristics	Posttest	Preschool ES	Preschool Mean ES	Kinder ES	Kinder Mean
					Phonological Awareness				
					Pre-CTOPP/CTOPP	+0.20	+0.20	+0.03	+0.03
					Mathematics				
					WJ Applied problems	+0.20	+0.12	+0.11	+0.06
					CMA-A Math composition	+0.08		0.00	
					Shape composition	+0.08		+0.06	
Let's Begin with the Letter People									
Assel et al. (2007)	Randomized (L)	1 year	22 schools 401 students (198E, 203C)	A fairly large economically diverse school district in greater Houston Texas	Language				
					PLS-IV	+0.03	-0.03		
					Expressive Vocabulary test	-0.09			
					Phonological Awareness				
					DSC auditory	+0.42	+0.42		
					Literacy				
					TERA	+0.02	+0.10	-0.13	-0.12
					WJ Letter Word ID	+0.10		-0.18	
					WJ Spelling	+0.17		-0.06	
					Language				
					PPVT	-0.03	+0.03	0.00	-0.06
					TOLD	+0.08		-0.12	
					Phonological Awareness				
					Pre-CTOPP/CTOPP	-0.13	-0.13	-0.13	-0.13
					Mathematics				
					WJ Applied Problems	-0.10	+0.09	-0.13	-0.09
					CMA-A Math Composition	+0.15		-0.07	
					Shape Composition	+0.21		-0.06	
					Literacy				
					Get Ready to Read	+0.32	+0.20		
					Letters Known	+0.31			
					WJ-R Letter Word ID	+0.29			
					WJ-R Dictation	+0.38			
					Book Knowledge	+0.12			
					Print Conventions	+0.23			
					Comprehension	-0.12			
Fischel et al. (2007)	Randomized Quasi-Experiment	3 - 1 year	35 classes 335 students (185E, 150C)	Six Head Start centers in SE New York State 42% African American, 41% Hispanic, 7% White, 8% multiracial; 14% Spanish					

Study	Design	Duration	N	Sample Characteristics	Posttest	Preschool ES	Preschool Mean ES	Kinder ES	Kinder Mean
					Language				
					PPVT	+0.06	+0.06		
Literacy Express									
					Literacy				
					TERA	+0.17	+0.17	-0.11	-0.01
					WJ Letter Word ID	+0.30		+0.08	
					WJ Spelling	+0.05		+0.06	
					Language				
					PPVT	+0.17	+0.07	+0.16	+0.13
					TOLD	-0.04		+0.10	
					Phonological Awareness				
					Pre-CTOPP/CTOPP	+0.14	+0.14	+0.08	+0.08
					Mathematics				
					WJ Applied problems	+0.05	-0.01	-0.02	-0.12
					CMA-A Math composition	-0.02		-0.21	
					Shape composition	-0.01		-0.14	
Montessori									
Miller & Dyer (1975)	Randomized	1 yr	64 students (22E, 34C)	African American students w lowest SES in Louisville, KY	Cognitive				
					IQ	-0.09	-0.09	-0.11	-0.11
PATHS									
					Cognitive				
Domitrovich et al. (2007)	Randomized	1 year	20 classes 201 students	Two regional Head Start programs in moderate sized cities in central PA. 47% African American, 38% White, and 10% Hispanic	Letter Sustained Attention	+0.16	+0.16		

Study	Design	Duration	N	Sample Characteristics	Posttest	Preschool ES	Preschool Mean ES	Kinder ES	Kinder Mean
Project Approach									
PCER (2008)	Randomized	2 years	13 classes 204 students (114E, 90C)	Public preschool programs in WI; 28% White, 40% African American, 17% Hispanic, 13% others	Literacy				
					TERA	+0.14	+0.28	+0.29	+0.15
					WJ Letter Word ID	+0.42		+0.03	
					WJ Spelling	+0.27		+0.14	
					Language				
					PPVT	+0.16	+0.16	+0.10	+0.21
					TOLD	+0.15		+0.32	
					Phonological Awareness				
					Pre-CTOPP/CTOPP	+0.05	+0.05	-0.17	-0.17
					Mathematics				
					WJ Applied Problems	+0.07	+0.17	+0.27	+0.24
					CMA-A Math Composition	+0.18		+0.22	
Shape Composition	+0.27	+0.24							
Project Construct									
PCER (2008)	Randomized	2 years	21 preschool programmes 231 students (123E, 108C)	Preschool centers from urban and rural MO; 65% White, 29% African American, 3% Hispanic, 6% others	Literacy				
					TERA	0.00	-0.07	-0.03	+0.04
					WJ Letter Word ID	-0.05		+0.16	
					WJ Spelling	-0.15		0.00	
					Language				
					PPVT	+0.03	-0.01	+0.10	+0.06
					TOLD	-0.05		+0.01	
					Phonological Awareness				
					Pre-CTOPP/CTOPP	+0.10	+0.10	-0.12	-0.12
					Mathematics				
					WJ Applied Problems	+0.06	-0.12	+0.08	+0.05
					CMA-A Math Composition	-0.11		-0.06	
Shape Composition	-0.42	+0.12							

Study	Design	Duration	N	Sample Characteristics	Posttest	Preschool ES	Preschool Mean ES	Kinder ES	Kinder Mean
Ready, Set, Leap!									
PCER (2008)	Randomized	2 years	39 classes 286 students (149E, 137C)	Preschools from an urban area in New Jersey 78% African American, 20% Hispanic	Literacy				
					TERA	+0.08	+0.10	+0.01	-0.02
					WJ Letter Word ID	+0.01		-0.12	
					WJ Spelling	+0.20		+0.04	
					Language				
					PPVT	+0.15	+0.02	-0.02	-0.03
					TOLD	-0.11		-0.03	
					Phonological Awareness				
					Pre-CTOPP/CTOPP	-0.09	-0.09	-0.02	-0.02
					Mathematics				
					WJ Applied problems	+0.04	-0.04	0.00	-0.02
					CMA-A Math composition	-0.24		-0.10	
					Shape composition	+0.08		+0.03	
RMC (2003)	Randomized	1 year	254 students (1E29, 125C)	17 high poverty inner-city Newark public primary schools. 44% African American, 37% Hispanic, 15% White	Literacy				
					Blending	+0.35	+0.18		
					Initial sound fluency	+0.21			
					Letter Word ID	+0.19			
					Rhyming	+0.18			
					Letter naming	-0.01			
					Language				
					Passage comprehension	+0.09	+0.10		
					PPVT	+0.01			
					LTRID composite	-0.05			
					PA composite	+0.33			

Study	Design	Duration	N	Sample Characteristics	Posttest	Preschool ES	Preschool Mean ES	Kinder ES	Kinder Mean
Abt Associates (2007)	Randomized	18 months	829 students (320E, 509C)	162 child care centers in Miami-Dade County Florida that served children from low-income families. 57% Hispanic, 24% White, and 19% African	Literacy				
					Definitional Vocabulary			+0.28	+0.48
					Print knowledge			+0.65	
					Early Literacy Index			+0.51	
					Phonological Awareness				
Phonological Awareness			+0.35	+0.35					
Research-Based, Developmentally Informed (REDI)									
Bierman et al. (2008)	Randomized	1 year	356 students	44 Head Start classrooms in three counties in PA. 25% African American, 42% White, 17%	Literacy				
					Print Awareness	+0.18	+0.18		
					Language				
					Picture Vocabulary	+0.16	+0.16		
					Phonological Awareness				
Blending and Elision	+0.43	+0.43							
Sound Foundations									
Byrne and Fielding-Barnsley (1991, 1995)	Randomized	12 weeks	128 students (64E, 62C)	Australia	Literacy				
		1-year follow up	119 students (63E, 56C)		Untrained Phonemes	+0.18	+0.44		
					Word Choice	+0.69			
					Literacy				
					Phoneme awareness			+0.30	+0.21
					Alphabet Knowledge			+0.00	
					Word identification			+0.09	
					Pseudoword ID			+0.53	
Spelling			+0.15						

Study	Design	Duration	N	Sample Characteristics	Posttest	Preschool ES	Preschool Mean ES	Kinder ES	Kinder Mean	
Tools of the Mind										
Barnett et al. (2008)	Randomized	1 year	18 classes 218 students (85E, 120C)	High poverty urban school district in NJ; 80% free lunch, 92% Hispanic	Literacy					
					Get Ready to Read	+0.03	-0.04			
					WJ-R Letter-Word	-0.11				
					Language					
					PPVT-III	+0.22	+0.16			
					EOWPVT-R	+0.11				
					Cognitive					
					WJ-R Applied Problems	+0.14	+0.10			
WIPPSI	+0.05									
Waterford										
Fischel et al. (2007)	Randomized Quasi- Experiment	3 - 1 year	35 classes 335 students (185E, 150C)	Six Head Start centers in SE New York State 42% African American, 41% Hispanic, 7% White, 8% multiracial; 14% Spanish	Literacy					
					Get Ready to Read	+0.32	+0.08			
					Letters Known	+0.12				
					WJ-R Letter Word ID	+0.11				
					WJ-R Dictation	+0.02				
					Book Knowledge	+0.00				
					Print Conventions	+0.21				
					Comprehension	-0.21				
					Language					
					PPVT	+0.06	+0.06			

Table 2: Effects by Program

Program	End of PreK						End of K					
	Studies (N)	Phonological					Studies (N)	Phonologica				
		Literacy	Lang	Awareness	Math	Cognitive		Literacy	Lang	lAwareness	Math	Cognitive
Breakthrough to Literacy	1	--	--	--	--	--	1	0.48	--	0.44	--	--
Bright Beginnings	1	0.31	0.11	-0.07	0.06	--	1	0.03	0.12	0.01	0.12	--
BELL	1	--	--	--	--	--	0	0.07	--	0.04	--	--
Creative Curriculum	2	0.01	0.06	0.06	0.12	--	2	0.11	0.06	0.06	0.07	--
Curiosity Corner	2	0.08	0.08	0.18	0.09	--	1	0.39	0.15	0.25	0.18	--
DARCEE	1	--	--	--	--	-0.11	1	--	--	--	--	-0.11
Dialogic Reading	1	--	-0.03	--	--	--	1	--	--	--	--	--
Direct Instruction	2	0.52	0.46	--	0.37	0.31	2	--	--	--	--	0.39
DLM with Open Court	1	0.55	0.4	0.32	0.26	--	1	0.49	0.47	0.38	0.23	--
Doors to Discovery	2	0.07	-0.05	0.15	0	--	1	-0.09	0.12	-0.09	-0.1	--
ELLM	2	0.19	0.16	0.18	-0.01	--	1	0.11	0.39	0.08	0.08	--
EMERGE	1	0.37	0.13	0.28	--	--	1	--	--	--	--	--
Interactive Book Reading	2	-0.33	0.86	--	--	--	0	--	--	--	--	--
Ladders to Literacy	1	-0.05	-0.3	-0.16	0.02	--	1	-0.3	-0.18	-0.1	-0.21	--
Language Focus Curriculum	1	0.17	0.02	0.2	0.12	--	1	0.06	-0.08	0.03	0.06	--
Let's Begin with the Letter												
People	3	0.15	-0.01	0.24	0.09	--	1	-0.12	-0.06	-0.13	-0.09	--
Literacy Express	1	0.17	0.07	0.14	-0.01	--	1	-0.01	0.13	0.08	-0.12	--
Montessori	1	--	--	--	--	-0.09	1	--	--	--	--	-0.11
Pre-K Mathematics plus DLM	1	0.11	0.17	0.04	0.33	--	1	0.19	0.10	-0.11	0.13	--
PATHS	1	--	--	--	--	0.16	0	--	--	--	--	--
Project Approach	1	0.28	0.16	0.05	0.17	--	1	0.15	0.21	-0.17	0.24	--
Project Construct	1	-0.07	-0.01	0.1	-0.12	--	1	0.04	0.06	-0.12	0.05	--
Ready, Set, Leap!	2	0.14	0.06	-0.09	-0.04	--	1	0.24	-0.03	0.18	-0.02	--
REDI	1	0.18	0.16	0.43	--	--	0	--	--	--	--	--
Sound Foundations	1	0.43	--	--	--	--	1	0.21	--	--	--	--
Tools of the Mind	1	-0.04	0.16	--	--	0.1	0	--	--	--	--	--
Waterford	1	0.08	0.06	--	--	--	0	--	--	--	--	--

Table 3 - Long Term Effects

DARCEE								
Miller & Bizzel (1984)	Randomized	1 year	96 pupils (64E, 32C)	African American pupils w lowest SES in Louisville, KY	Random assignment	Cognitive (IQ)		
						10th grade	-0.14	
						Literacy (Reading)		
						8th grade	+0.17	
Montessori								
Miller & Bizzel (1984)	Randomized	1 year	64 pupils (22E, 34C)	African American pupils w lowest SES in Louisville, KY	Random assignment	Cognitive (IQ)		
						10th grade	-0.01	
						Literacy (Reading)		
						8th grade	+0.56	
Direct Instruction								
Miller & Bizzel (1984)	Randomized	1 year	98 pupils (64E, 34C)	African American pupils w lowest SES in Louisville, KY	Random assignment	Cognitive (IQ)		
						10th grade	-0.13	
						Literacy (Reading)		
						8th grade	+0.28	
Evans (1985)	Retrospective	1-2 years	44 pupils (27E, 17C)	Subjects were low income, minority (mostly black) pupils in urban school districts	Similar preschool WPPSI mean scores between the two surviving groups (DI and High/Scope)	Literacy (MAT Reading)		
						8th grade	+0.43	
						Mathematics		
						8th grade	-0.03	
Learning to Learn								
Sprigle & Schaefer (1985)	Randomized	2-3 years	90 pupils	4 and 5 yr old African American children from the same neighborhood	Random assignment with similar IQ pretests	Literacy (Reading)		
						6th grade	+0.51	
						6th grade		
						Educational		
						Special Education	+0.57	+0.60
						Grade Retention	+0.62	