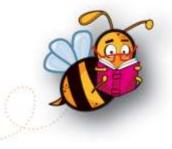# Effective Early Childhood Education Programmes: A Systematic Review

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Abstract

This report systematically reviews research on the outcomes of programmes that teach young children in a group setting before they begin reception. Study inclusion criteria included use of randomised 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 programmes met these criteria for outcomes assessed at the end of preschool and/or reception/kindergarten.

The review concludes that on academic outcomes at the end of preschool and/or reception, 6 early childhood programmes showed strong evidence of effectiveness and 5 had moderate evidence of effectiveness. Of the 27 programmes reviewed, 7 are available for implementation in the UK.

A few longitudinal studies have followed their subjects into secondary school, and even adulthood. These studies show that comprehensive programmes 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 Programmes:
A Systematic Review

The education of young children who are at risk for school failure is widely recognised as an important factor in determining future school success. Previous reviews of programmes for children between the age of 3 and entry into reception or 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 4 and 8 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 programmes 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 programmes, and trying to improve the quality of the ones that exist.

Recent evaluations of Sure Start, The UK's largest early childhood programme have demonstrated mixed findings. While there have been positive impacts on social development and health outcomes, there has been no significant impact on oral language development, an important precursor to success in school (Belsky & Melhuish, 2007). However, evaluations of Head Start and other early childhood programmes in the US, the UK, 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 or nursery programme is most effective for young children? Which particular programmes have positive outcomes and what elements of these programmes contribute to their effectiveness?

The present report reviews the evidence for the effectiveness of various preschool/nursery programmes for young children who are at risk of school failure due to poverty. It reviews the research on the outcomes of early childhood programmes 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 programmes to implement and to inform researchers about the current evidence on nursery programmes and guide further research. The scope of the review includes all types of programmes that children's centre directors, head teachers, or child care directors might consider adopting to prepare their children for success in primary 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 carried out cost-benefit analyses 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 identify which types of interventions were most effective. Barnett (1995) reviewed 36 studies of preschool attendance, Head Start, child care, and home visiting programmes. 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 programmes.

Based on the early reviews of long-term effects of preschool programmes, new programmes have been developed in recent years. Most of these new programmes 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 programmes, and often the experimental programmes 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 programmes and found that academic programmes generally produced better immediate and mid-term cognitive outcomes. However, cognitive-developmental programmes produced better long-term educational and social adjustment outcomes. In addition to curriculum, another factor that differentiated programmes 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 programme 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 programmes.

The 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 EAL.

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 children who have EAL. 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 programmes. Several key evaluations of early childhood programmes have recently been conducted, notably the Preschool Curriculum Research Evaluation, a US Department of Education cross-site evaluation of 14 different early childhood programmes (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 programmes 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 programmes most likely to benefit their children's school readiness. The review emphasises practical programmes that are or could be used at scale. To make the review most useful to educators and policy makers, it emphasises large studies done over significant time periods that used standard measures. It also identifies common characteristics of programmes 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 programmes 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 behaviour, rather than on unbiased observations of children's actual behaviour. 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 behaviour. Unfortunately, there were not enough such studies to report in this review. Therefore the outcomes summarised 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. Programme evaluations that follow children at least through the end of reception and into primary 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 programmes (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 from1960 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 programme 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. Appendix A lists the initial search strategy.

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 programmes met the inclusion criteria described in the following section.

Inclusion criteria

The studies evaluated programmes and practices for the education of groups of young children. Studies of parenting programmes, nutrition interventions, and programmes for individual children, such as home visitation programmes, were not reviewed. The studies involved children between the ages of 3 and 5 or in the year or two before they began reception or kindergarten.

The studies compared children taught in classes using a given programme or specified replicable practice to those using an alternative programme 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 primary schools, child-care centres, Head Start centres, or Sure Start centres. Any early childhood setting that offered a regularly scheduled educational programme 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 programmes 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 pre-test 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 pre-test. If they were not randomly assigned there needed to be evidence of initial equality on assessments similar to post-test 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 pre-test 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 be placed into treatments (e.g., chose to attend a particular school program) or were specially selected into treatments (e.g., gifted programmes) were excluded unless experimental and control groups were designated after selections were made.

Sample Size

Studies needed to have least 2 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 (eg, 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 emphasised in control groups, were excluded. This included measures in which the children's teachers rated their social or cognitive skills or behaviours. Teachers in the treatment groups might have had their perceptions of the children's behaviour influenced by their knowledge of being in a study and knowing the goals of the intervention.

Intermediate Outcomes

Most studies that followed children into reception, or further into primary 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 secondary school and higher education.

Duration

A minimum study duration of 12 weeks was required. This requirement was intended to focus the review on practical programmes and practices intended for extended use, rather than brief investigations. Brief studies may not allow programmes 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 pre-test 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 pre-test, provided 6 weeks of intensive tutoring, and then gave an immediate post-test, it would not be included, but if students were given a follow-up test 20 weeks after pre-test, 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 reception.

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 pupil post-tests after adjustment for pre-tests and other covariates, divided by the unadjusted post-test control group standard deviation. 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 pre-test and post-test means and SD's were presented but adjusted means were not, effect sizes for pre-tests were subtracted from effect sizes for post-tests.

Effect sizes were pooled across studies for each programme and for various categories of programmes. This pooling used means weighted by the final sample sizes. The reason for using weighted means is to maximise 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 programmes. However, to compare the effectiveness of programmes, one needs quantitative evidence that can be evaluated on a common scale.

Second, the review focuses on replicable programmes 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 programmes, 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 standardised tests. These are useful in assessing the

practical outcomes of various programmes 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 behaviours, 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. *Randomised experiments* were those in which pupils, 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 categorised as a *randomised quasi-experiment* (Slavin, 2008). *Matched* studies were ones in which experimental and control groups were matched on key variables at pre-test, 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 randomised designs are preferable to randomised quasi-experiments, but all randomised 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, pupil outcomes, and study quality are summarised 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 programme more easily understandable and usable for educators searching for programmes with evidence of effectiveness, the programmes are presented on a rating scale. This is a modified version of a rating system that Slavin (2008) developed for the Best Evidence Encyclopaedia to balance methodological quality, weighted mean effect sizes, sample sizes, and other factors. The categories of effectiveness are as follows.

⬡ Strong Evidence of Effectiveness

Programmes in this category were evaluated in at least two studies, one of which is a large randomised or randomised 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 pupils or 20 classes. The effects can be on any of the academic or cognitive outcomes, at the end of preschool and/or reception/kindergarten.

⬡ Moderate Evidence of Effectiveness

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

⬡ Limited Evidence of Effectiveness: Strong Evidence of Modest Effects

Programmes 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.

⬡ Limited Evidence of Effectiveness: Weak Evidence with Notable Effects

Programmes 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

Programmes in this category do not have any qualifying studies.

Summaries of Programmes and Studies

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

TABLE 1 - Outcomes for Included Studies										
Study	Design	Duration	N	Sample Characteristics	Evidence of Initial Equality	Post-test	Preschool ES	Preschool Mean ES	Reception/ Kinder ES	Reception/ Kinder Mean ES
Breakthrough to Literacy									-	
Abt Associates (2007)	Randomised	18 months	863 pupils (354E, 509C)	162 child care centres in Miami-Dade County that served children from low-income families. 57% Hispanic, 24% White, and 19% African American	Well matched on pre-test scores	**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)	Randomised	2 years	14 classes 208 pupils (103E, 105C)	Seven school districts in six counties in TN; 80% White, 18% African American, 11% Hispanic	Matched on pretest and demographics	**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				

						Measure				
						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	
Pre-K Mathematics plus DLM Early Childhood Express Math Software	-	-	-	-	-	-	-	-	-	-
PCER (2008)	Randomised	2 years	40 classes 316 pupils (159E, 157C)	Head Start and public preschool programmes in CA and NY; 18% White, 45% African American, 23% Hispanic, 13% others	Matched on pretest, child characteristics, and demographics	**Literacy**				
						TERA	+0.13	+0.11	+0.31	+0.19
						WJ Letter Word ID	-0.01		+0.22	
						WJ Spelling	+0.20		+0.03	
						Language				-
						PPVT	+0.17	+0.17	+0.11	+0.10
						TOLD	+0.17		+0.08	
						Phonological Awareness				
						Pre-CTOPP/CTOPP	+0.04	+0.04	-0.11	-0.11
						Mathematics				
						WJ Applied problems	+0.22	+0.22	+0.13	+0.13
Building Early Language and Literacy (BELL)										
Abt Associates	Randomised	18 months	849 pupils (340E,	162 child care centres in Miami-Dade	Well matched on pretest	**Literacy**				
						Early Literacy Index			+0.06	+0.07

(2007)			509C)	County Florida that served children from low-income families. 57% Hispanic, 24% White, and 19% African American	scores	Print knowledge			+0.07	
						Definitional Vocabulary			+0.07	
						Phonological Awareness				
						Phonological Awareness			+0.04	+0.04
Creative Curriculum					-	-	-	-	-	
PCER (2008) (Tennessee)	Randomised	2 years	14 classes 206 pupils (101E, 105C)	Seven school districts in six counties in TN; 80% White, 18% African American, 11% Hispanic	Matched on pretest, child characteristics, and demographics	**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)	Randomised	2 years	18 classes 194 pupils (97E, 97C)	Head Start centres in NC and GA; 3% White, 85% African American, 8% Hispanic	Matched on pretest, child characteristics, and demographics	**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	
Curiosity Corner	-	-	-	-	-	-	-	-	-	
PCER (2008)	Randomised	2 years	18 pre-K programmes 225 pupils (105E, 110C)	Preschool programmes in FL, KS, and NJ; 28% White, 51% African American, 14% Hispanic, and 8% others	Matched on pretest, child characteristics, and demographics	**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

Study	Design	Duration	Sample	Population	Matching	Outcome				
						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 pupils (206E, 110C)	3 and 4-year-old children enrolled in child care centres and preschools in 4 high poverty urban school districts in New Jersey	Matched on demographics. Pretest scores used as covariates to adjust for initial differences	**Language**				
						Expressive Language	+0.24	+0.15		
						Receptive Language	+0.06			

The Demonstration and Research Center for Early Education (DARCEE)

Study	Design	Duration	Sample	Population	Matching	Outcome				
Miller & Dyer (1975)	Randomised	1 yr	98 pupils (64E, 34C)	African American pupils with lowest SES in Louisville, KY	Random assignment	**Cognitive (IQ)**				
						End of preschool	-0.11	-0.11		
						Kindergarten			-0.11	-0.11

Dialogic Reading

Study	Design	Duration	Sample	Population	Matching	Outcome				
Whitehurst et al. (1994)	Randomised	6 week interention with follow-up	70 pupils (46E, 24C)	Five day care centres in Suffolk County, New York. 22%	Well matched on pretest scores	**Language**				
						One Word	+0.13	-0.03		
						PPVT	-0.17			

		at 6 months		White, 55% African American, and 23% Hispanic		ITPA	-0.01			
Direct Instruction				-	-	-	-	-	-	
Miller & Dyer (1975)	Randomised	1 year	98 pupils (64E, 34C)	African American pupils with lowest SES in Louisville, KY	Random assignment	**Cognitive (IQ)**				
						End of preschool	+0.11	+0.11		
						Kindergarten			-0.02	-0.02
Salaway (2008)	Randomised	6 months	61 pupils (35E, 26C)	A preschool centre in an urban, at risk community. 20% White, 69% African American, 2% Hispanic, and 10% others	Well matched on pretest scores	**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 pupils (15E, 28C)	Four-year old culturally disadvantaged children who were eligible for Head Start	Well-matched on initial IQ test scores, SES, and ethnicity	**Cognitive (IQ)**				
						End of preschool	+0.66	+0.66		
						End of K			+1.34	+1.34

DLM Express plus Open Court

Study	Design	Duration	Sample	Population	Matching	Outcome				
PCER (2008)	Randomised	2 years	11 preschool programmes 198 pupils (101E, 97C)	Public preschool programmes in FL; 30% White, 59% African American, 6% Hispanic, 5% others	Matched on pretest, child characteristics, and demographics	**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	
						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

Study	Design	Duration	Sample	Population	Matching	Outcome				
PCER (2008)	Randomised	2 years	29 classes 297 pupils (101E, 96C)	Head Start and public preschool programmes in TX; 30% White, 13% African American, 43% Hispanic, 13%	Matched on pretest, child characteristics, and demographics	**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				-

				others		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	
Assel et al. (2007)	Randomised	1 year	22 schools 409 pupils (206E, 203C)	A fairly large economically diverse school district in greater Houston Texas	Matched on pretests and demographics	**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)				-	-	-	-	-	-	
Cosgrove et al. (2006)	Randomised	1 year	466 pupils (222E, 244C)	Head Start, subsidised, faith based and preschool classrooms from 3 locations in FL; 14% White, 71% African American, 8% Hispanic, 6%	Matched on pretest, child characteristics, and demographics	**Literacy**				
						Reading Quotient	+0.28	+0.25		
						Alphabet	+0.28			
						Prints	+0.17			
						Meaning	+0.29			-
						Alphabet Letter Recognition	+0.25			

				others						
PCER (2008)	Randomised	1 yr	28 classes244 pupils(137E, 107C)	Head Start, subsidised, faith based and preschool classrooms from 3 locations in FL;14% White, 71% African American, 8% Hispanic, 6% others	Matched on pretest, child characteristics, and demographics	**Literacy**				
						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 pupils (188E, 154C)	Low SES Head Start and preschool centres in Milwaukee, Wisconsin, 90% African	Matched on pretests and demographics	**Literacy**				
						Alphabet Knowledge	+0.32	+0.37		
						Story Telling	+0.40			
						Picture Naming	+0.63			
						Print Awareness	+0.49			

					American		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)	Randomised Quasi-Experiment	15 weeks	121 pupils	Title 1 early learning centre in Baltimore, Maryland. 94% African American, 95% Free Lunch	Matched on pretests and demographics	**Language**			-	
							PPVT III	+0.63	+1.33	-	
							Receptive	+1.45			
							Expressive	+1.92			
Wasik, Bond, & Hindman (2006)	Randomised Quasi-Experiment	1 year	16 classes 207 pupils (139E, 68C)	2 Head Start centres in 2 Title I high-poverty Baltimore schools; 99% AA	Matched on pretests and demographics	**Literacy**	-	-		
							Alphabet Knowledge	-0.33	-0.33		
							Language				
							Receptive Language	+0.73	+0.59		
							Expressive Language	+0.44			
Ladders to Literacy					-	-	-	-	-	-	
PCER (2008)	Randomised	2 years	14 classes 123 pupils	Head Start centres in NH 38% White,	Matched on pretest, child characteristics,	**Literacy**				
							TERA	-0.30	-0.05	-0.54	-0.30

						Measure				
			(62E, 61C)	11% African American, 30 Hispanic, and 20% others	and demographics	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)	Randomised	2 years	14 classes 195 pupils (97E, 98C)	Head Start and public preschool classrooms in VA; 71% White, 21% African American, 4% Hispanic, 3% others	Matched on pretest, child characteristics, and demographics	**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	
						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)	Randomised (L)	1 year	22 schools 401 pupils (198E, 203C)	A fairly large economically diverse school district in greater Houston Texas	Matched on pretests and demographics	**Language**				
						PLS-IV	+0.03	-0.03		
						Expressive Vocabulary test	-0.09			
						Phonological Awareness				
						DSC auditory	+0.42	+0.42		
PCER (2008)	Randomised	2 years	30 classes 196 pupils (100E, 96C) Shared same control group with Doors to Discovery	Head Start and public preschool programmes in TX 30% White, 13% African American, 43% Hispanic, 13% others	Matched on pretest, child characteristics, and demographics	**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

Study	Design	Duration	Sample	Setting	Matching	Outcome				
						CMA-A Math Composition	+0.15		-0.07	
						Shape Composition	+0.21		-0.06	
Fischel et al. (2007)	Randomised Quasi-Experiment	3 - 1 year	35 classes 335 pupils (185E, 150C)	Six Head Start centres in SE New York State 42% African American, 41% Hispanic, 7% White, 8% multiracial; 14% Spanish	Matched on pretests, teacher credentials, and pupil's primary language	**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			
						Language				
						PPVT	+0.06	+0.06		
Literacy Express	-	-	-	-	-	-	-	-	-	
PCER (2008)	Randomised	2 years	12 preschool programmes 195 pupils (99E, 97C)	Public preschool programmes in FL; 30% White, 59% African American, 6% Hispanic, 5% others	Matched on pretest, child characteristics, and demographics	**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)	Randomised	1 yr	67 pupils (33E, 34C)	African American pupils w lowest SES in Louisville, KY	Random assignment.	**Cognitive**				
						IQ	-0.09	-0.09	-0.11	-0.11
PATHS			-	-	-	-	-	-	-	
Domitrovich et al. (2007)	Randomised	1 year	20 classes 201 pupils	Two regional Head Start programmes in moderate sized cities in central PA. 47% African American, 38% White, and 10% Hispanic	Well matched on pretest scores and other demographics	**Cognitive**				
						Leiter Sustained Attention	+0.16	+0.16		
Project Approach	-	-	-	-	-	-	-	-	-	
PCER (2008)	Randomised	2 years	13 classes 204 pupils	Public preschool programmes in	Matched on pretest, child characteristics,	**Literacy**				
						TERA	+0.14	+0.28	+0.29	+0.15

						Measure				
			(114E, 90C)	WI; 28% White, 40% African American, 17% Hispanic, 13% others	and demographics	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)	Randomised	2 years	21 preschool programmes 231 pupils (123E, 108C)	Preschool centres from urban and rural MO; 65% White, 29% African American, 3% Hispanic, 6% others	Matched on pretest, child characteristics, and demographics	**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	
Ready, Set, Leap!	-	-	-	-	-	-	-	-	-	
PCER (2008)	Randomised	2 years	39 classes 286 pupils (149E, 137C)	Preschools from an urban area in New Jersey 78% African American, 20% Hispanic	Matched on pretest, child characteristics, and demographics	**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)	Randomised	1 year	254 pupils	17 high poverty	Well matched	**Literacy**				

Study	Design	Duration	Sample	Setting	Matching	Outcome	ES1	ES2	ES3	ES4
			(1E29, 125C)	inner-city Newark public primary schools. 44% African American, 37% Hispanic, 15% White	on pretest scores	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			
Abt Associates (2007)	Randomised	18 months	829 pupils (320E, 509C)	162 Child Care centres in Miami-Dade County Florida that served children from low-income families. 57% Hispanic, 24% White, and 19% African American	Well matched on pretest scores and	**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)	Randomised	1 year	356 pupils	44 Head Start classrooms in three counties	Matched on pretests, length of	**Literacy**				
						Print Awareness	+0.18	+0.18		

				in PA. 25% African American, 42% White, 17% Hispanic	programmes, location, and demographics	**Language**				
						Picture Vocabulary	+0.16	+0.16		
						Phonological Awareness				
						Blending and Elision	+0.43	+0.43		
Sound Foundations				-	-		-	-	-	
Byrne and Fielding-Barnsley (1991, 1995)	Randomised	12 weeks	128 pupils (64E, 62C)	Australia	Matched on pretests and age	**Literacy**				
						Untrained Phonemes	+0.18	+0.44		
						Word Choice	+0.69			
		1-year follow up	119 pupils (63E, 56C)			**Literacy**				
						Phoneme awareness			+0.30	+0.21
						Alphabet Knowledge			+0.00	
						Word identification			+0.09	
						Pseudoword ID			+0.53	
						Spelling			+0.15	
Tools of the Mind										
Barnett et al. (2008)	Randomised	1 year	18 classes 218 pupils (85E, 120C)	High poverty urban school district in NJ; 80% free lunch, 92% Hispanic	Matched on pretests and demographics	**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)	Randomised Quasi-Experiment	3 - 1 year	35 classes 335 pupils (185E, 150C)	Six Head Start centres in SE New York State 42% African American, 41% Hispanic, 7% White, 8% multiracial; 14% Spanish language dominant	Matched on pretests, teacher credentials, and pupil's primary language	**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 Programme

Programme	End of PreK						End of K					
	Studies (N)	Literacy	Lang	Phonological Awareness	Math	Cognitive	Studies (N)	Literacy	Lang	Phonological Awareness	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	0.22	--	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	--	--	--	--	--

In some cases, a number of programmes were evaluated in one study. In these cases, the overall design of the study is presented just before the first programme is introduced and then referred back to when subsequent programmes 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) Programme 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 randomised 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 1 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 summarised but the methods are not repeated for each PCER evaluation presented. Teacher and parent interviews and ratings of children' behaviour 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 programme published by the Wright Group, which aims at promoting language development and literacy skills among preschool children. The programme uses systematic, direct instruction built around a series of weekly books in the classroom. Interactive computer programmes are also used to engage pupils in individualised activities, also organised 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 programmes on teacher behaviours, classroom environments, and pupil outcomes—Ready, Set, Leap!, Building Early Language and Literacy (BELL), and Breakthrough to Literacy (BTL). (See sections for the other curricula for their impact.) One hundred sixty-two centres 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 centre had to primarily serve low-income children and at least one class of four-year-old children with at least five children. In centres where there was more than one class of four year olds, the class with most low SES children was chosen. Children were pre-tested 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 analyse the data with age, gender, language spoken at home, and classroom mean pre-test scores as covariates. At the end of

kindergarten, pupils 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).

Bright Beginnings

Bright Beginnings is an integrated curriculum with a focus on language and early literacy. The curriculum goals are to provide a consistent, child-centred, literacy-focused programme 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 Early Language and Literacy (BELL)

Building Early Language and Literacy (BELL) is a preschool supplementary programme 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 classroom to build vocabulary and promote awareness of story sequencing and characters. The programme 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 programmes on teacher behaviours, 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 - averaged literacy measures (ES = +0.07) and phonological awareness (ES = -0.04).

Creative Curriculum

Creative Curriculum is a comprehensive approach to education for 3- to 5-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 programme. 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 programmes 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 centres 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 programme, 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 programme 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 programme 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 randomised 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 pre-test scores, there were no significant differences at the end of preschool but there were significant differences favouring the Curiosity Corner preschool attendees on literacy at the end of kindergarten (ES = +0.39) and nonsignificant 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 centres 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 pre-tests 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 programme 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 programmes: two academic programmes (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 programmes 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 programme. 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.
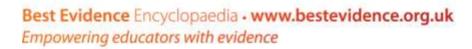

Dialogic Reading

Dialogic Reading is an emergent literacy intervention programme developed by Whitehurst and his colleagues (1994). The programme is an interactive story reading programme aimed at improving the oral language and listening comprehension abilities of young children. Children in the Dialogic Reading programme 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 programme, 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 programme in five day-care centres in Suffolk County, New York. A total of 73 three year olds were pre-tested on several standardised tests of language ability and were randomly assigned within classrooms to one of three conditions in a 6-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 pupils were 55% African American and 23% Hispanics. In the school reading condition, children were engaged in Dialogic Reading with a teacher in a small group setting, usually no more than 5 children. In addition, pupils participated in a daily shared reading session for approximately 10 minutes with their reading group. In the school plus home reading condition, pupils 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 6-week intervention and again at a 6-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 pre-test 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 el al., 1999).

Direct Instruction

Direct Instruction (DI) is a programme first developed by Bereiter and Englemann (1966) as an instructional method for at-risk children. DI is a teacher-directed programme 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 programme is on basic academic concepts, such as arithmetic and reading.

Engelmann (1968) in a small matched study involving both disadvantaged and middle class pupils examined the effectiveness of Direct Instruction on IQ and achievement in reading and arithmetic. Pupils were well matched on initial IQ, gender, ethnicity, and SES. The fifteen 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 4. In contrast, twenty-eight disadvantaged children in the control group attended a regular preschool programme, which emphasised 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 programme, but these data were excluded because there were no pre-tests 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 programmes.

The Louisville Experiment. In their Louisville experiment, Miller and Dyer (1975) compared four different programmes: 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 3 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 6-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 programme, compared to a control group, as the effects were only reported for the two programmes 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 programmes for participation in the study. Two teachers from each of the 16 participating schools were recruited to participate. All of the programmes were full-day programmes. The final study sample included 30 teachers and classrooms across three conditions (9 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 pre-test difference on the WJ Letter Word Identification test (ES = +0.41). Controlling for the pre-test 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 pre-test 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 programme had the largest impact on for language and literacy outcomes of any programme in the PCER project.

Doors to Discovery

The Doors to Discovery curriculum is a preschool programme 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 programme focuses on the use of learning centres 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 so 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 programme in 22 schools including Head Start centres 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 pre-tests. Two hundred and six pupils 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 standardised language scales. A test of phonological awareness showed an effect size of +0.12. Another comparison in this study included 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 programmes 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) programmes 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 nonsignificant 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 programme 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 programme 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, subsidised faith-based, and early intervention prekindergarten classrooms. All of the classrooms were full-day programmes. 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 4-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) on five literacy scores: Alphabet (ES = +0.28), Conventions of Print (ES = +0.17), Meaning (ES = +0.29), the Reading Quotient of the Test of Early Reading Ability – Third Edition (TERA-3) (ES = +0.28), and the Alphabet Letter Recognition Inventory (ALRI) (ES = +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, for an average effect size of +0.25.

Exemplary Model of Early Reading Growth and Excellence (EMERGE)

EMERGE is a literacy-based programme designed to help children from low-income families acquire early literacy skills. The programme 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 programme also includes family involvement and home-based activity components.

Gettinger & Stoiber (2007) of the University of Wisconsin designed and implemented the EMERGE programme, which incorporates a response-to-intervention (RTI) model. They evaluated the model in a matched 1-year study, implemented in 15 classrooms housed in five centre-based early childhood centres. The participating classrooms provided full-day, year-round programming for children across two consecutive years prior to kindergarten. A total of 342 pupils 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 pre-tests 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 programme is an adaptation of the Dialogic Reading programme, but where Dialogic Reading is usually used in a one-on-one or small group setting, the interactive book reading programme 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 with 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 Interactive Book Reading on preschoolers. Participants were 121 children from a public early childhood centre 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 randomised quasi-experiment. All children were pre-tested 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 for an average effect size +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 programme included: 1) asking questions, 2) building vocabulary, and 3) making connections. Two Head Start centres were randomly assigned to treatment and control condition with a total of 207 pupils from low socio-economic families, mostly African Americans. The children were pre-tested 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 effects 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 organised 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 individualise 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 pupil-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 3- to 5-year-old children with language limitations, including children with language impairment; children from disadvantaged backgrounds; and English-language learners. The curriculum has a thematic organisation 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 emphasises early language and literacy development through play. In addition to classroom teaching, the programme 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 programme). Thirty-five Head Start preschool classrooms in six centres were randomly assigned to one of the aforementioned programmes 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, pupils 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 programmes 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 pupil-level outcomes were found. In preschool effect sizes were slightly positive while in kindergarten they were slightly negative.

Across all studies, the average weighted effect size for Let's Begin 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 3-4 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 programmes to participate in the study. The final study sample included 30 teachers and classrooms across three conditions (9 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%).

No significant impacts on the prekindergarten or kindergarten child outcomes were found. Nonsignificant literacy effects of +0.17 in pre-k faded to -0.01 in kindergarten, but there were kindergarten effects of +0.13 on language, +0.08 on phonological awareness, and -0.12 on maths.

Montessori

Maria Montessori developed a programme 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 programme that emphasised 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 programmes: Direct Instruction; Montessori; a community integrated programme, 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 programme 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 programmes: two academic programmes (Direct Instruction and DARCEE), Montessori, and traditional instruction. In 1968, 214 four-year-old children were randomly assigned to the four programmes 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 Mathemtatics 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 1 to 2 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 4 to 6 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 centres for use during free play.

The DLM Early Childhood Express Math software included 26 numerical, quantitative, geometric, and spatial activities. The software programme provided individualised 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 Berkley and SUNY Buffalo recruited five Head Start and public school prekindergarten programmes in California and two Head Start and public school prekindergarten programmes in New York. A total of 40 teachers/classrooms (20 in each state) were recruited from these Head Start and public school prekindergarten programmes to participate in the study. Twenty-six (12 in California and 14 in New York) of the 40 classrooms were full-day prekindergarten programmes. 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, specialised 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 programme level (five programmes in California and two in New York), with teachers from Head Start and state-funded programmes 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, nor was the Child Mathematic Assessment as it was created by the developers of the programme. There was an unusual pattern of effects for the Pre-K Mathematics with DLM programme. The effect sizes on mathematics and language in preschool (+0.22 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, behavioural, and cognitive skill domains, the Promoting Alternative Thinking Strategies (PATHS) is a social-emotional curriculum, delivered in a developmentally- appropriate sequence. The curriculum emphasises affective awareness of self and others, targeting children's ability to self-regulate their behaviour.

Domitrovich et al. (2007) tested the effectiveness of PATHS for preschoolers in a randomised study. The first year of the 3-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 centres (246 children in total) were randomly assigned to 10 intervention and 10 controls conditions. Demographically, the participant sample reflected the make-up of their Head Start centres in terms of race, gender and SES indicators. On pre-test measures, intervention and control pupils performed similarly. Delivery of the treatment consisted of 30 lessons. At post-test, 201 pupils 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

The 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 organising 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 programme and can extend over several days or weeks. The structural features of the 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 (7 treatment and 6 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). Mathematics effects were slightly higher in kindergarten (ES = +0.24) than in prekindergarten (ES = +0.17), but the literacy scores dropped from an effect size in prekindergarten of +0.28 to +0.15 and phonological awareness scores from +0.05 to -0.17.

Project Construct

Project Construct was developed under the direction of the Missouri Department of Elementary and Secondary Education in 1986 to fulfil 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 organised around 29 goals for pupils 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 centres, 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 9 thematic units, each with detailed lesson plans for large- and small-group instruction, and ongoing assessment tools. The programme stresses the importance of experiential learning, social and emotional development, teacher-child relationships, and home-school connection. 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 emphasises phonological awareness, alphabetic knowledge, print awareness, oral language development, reading aloud, and reading comprehension through story discussion. The technology is designed to provide thematic centre-based activities that provide individualised feedback to pupils. There is also a component to encourage parent-child interactions and to forge strong home-school connections.

PCER (2008). For the PCER project, University of California, Berkeley researchers, in collaboration with RMC Research, implemented Ready, Set, Leap! The research team recruited 21 full-day prekindergarten programmes 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 randomised study of Ready, Set, Leap! (RSL) Program 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 pre-test scores

and other characteristics. All children were pre-tested in autumn 2002 and post-tested in spring 2003. On average, 44% of pupils were African American, 37% Hispanic, and 15% Caucasian. A two-level hierarchical linear analysis with pre-tests 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 programmes on teacher behaviours, 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 pupils 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 programme that was integrated into regular Head Start centres that use High/Scope or Creative Curriculum. This programme is designed to promote academic and social-emotional school readiness to preschoolers by training teachers using programme-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 centre activities, for emergent literacy skills. Teachers received a 3-day intensive training prior to the intervention and a 1-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 4-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 programme, location, and demographics was used. To account for the nested nature of the data (ie, pupils 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 programme developed in Australia by Byrne and Fielding-Barnsley (1991). The focus of the programme is on recognition of phoneme identity across words with special attention paid to 9 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 4-6 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 programme 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 4-6 for twelve weeks; the controls were also trained in reading in a small group of 4-6 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 reception/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 3-4 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 maths skills. The activities emphasise 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 randomised 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) programmes.

Children were pre-and post-tested as individuals. Some measures were given in Spanish to Spanish-dominant children. Adjusting for pre-tests, there were non-significant effects with effect sizes for language (ES = +0.17), cognition (ES = +0.06), maths (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 randomised quasi-experimental evaluation of Waterford in six Head Start centres in south-eastern New York State. The children were four year olds, and were 42% African American, 41% Hispanic, 8% multiracial, and 7% White. 14% 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 centres 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 8 measures. Adjusting for pre-tests, 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 on studies of programmes that were evaluated initially in the 1960s and70s. This section summarises 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 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 of 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 summarised in Table 3.

Table 3								
DARCEE								
Miller & Bizzel (1984)	Randomised	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)	Randomised	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)	Randomised	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)	Similar preschool WPPSI mean	**Literacy (MAT Reading)**		
						8th grade	+0.43	

				pupils in urban school districts	scores between the two surviving groups (DI and High/Scope)	**Mathematics**		
						8th grade	-0.03	
Learning to Learn								
Sprigle & Schaefer (1985)	Randomised	2-3 years	90 pupils	4 and 5 yr old African American children from the same neighbourhood	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	

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, pupils who attended High/Scope and nursery programmes 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 programmes.

Learning to Learn. Sprigle and Schaefer (1985) followed up a randomised evaluation of Learning to Learn, a cognitive-developmental program, in comparison to a standard Head Start programme (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 favoured 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 programme in kindergarten achieved at the same level as those who began in preschool.

The Louisville Experiment. Miller and Dyer (1975) compared four different programmes: two academic programmes (Direct Instruction and DARCEE) and one cognitive-developmental programme (Montessori), to a traditional control group. In 1968, two hundred and fourteen 4-year-old children were randomly assigned to the four programmes 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 programme.

The children were tested each spring through second grade on measures of IQ, achievement, curiosity, persistence, inventiveness and classroom behaviour. 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 programmes: Direct Instruction (Bereiter & Engelmann, 1966); Montessori; a community integrated programme,

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 programme 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 programme. The Direct Instruction programme 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 programmes have better long-term outcomes than solely academic programmes.

Summarising Evidence of Effectiveness for Programmes

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

Strong Evidence of Effectiveness

Six early childhood programmes 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 randomised:

- Curiosity Corner
- Direct Instruction
- ELLM
- Interactive Book Reading
- Let's Begin with the Letter People
- Ready Set Leap!

The effects for these programmes 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 reception/kindergarten (Curiosity Corner, ELLM, Ready Set Leap!).

Moderate Evidence of Effectiveness

Five programmes had at least one randomised 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
- Project Approach
- Pre-K Mathematics plus DLM Express Software

Limited Evidence of Effectiveness:
Strong Evidence of Modest Effects

Three programmes 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 Focus Curriculum
- Literacy Express

⬡ Limited Evidence of Effectiveness: Weak Evidence with Notable Effects

Three programmes 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 pupils.

- EMERGE
- PATHS
- Sound Foundations

⬡ Insufficient Evidence of Effectiveness

Studies of the following programmes 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 programmes did not have any qualifying studies.

- Abecedarian
- Building Blocks
- Early Authors Program
- High/Scope
- Reggio Emilia
- Scholastic Preschool Program

Programmes Available in the UK

Some of the programmes included in this review are no longer distributed. Of those that are in distribution, the following are currently available in the UK:

- Breakthrough to Literacy

- Creative Curriculum
- Curiosity Corner
- High/Scope
- Montessori
- PATHS
- Tools of the Mind

Discussion

The findings of this systematic review are consistent with the common-sense expectation that children learn what they are taught. The programmes 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 emphasised in kindergarten or later produce immediate effects on those skills. However, several programmes 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 programmes had effects on oral language skills, which are emphasised in most preschools.

Of the 27 programmes evaluated, 6 showed strong evidence of effectiveness and 5 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 programmes for improving the outcomes for children at risk due to poverty, the increasing number and quality of the studies on early childhood programmes is heading the field in the right direction.

The findings from the end of preschool or reception for the recent studies reported should be interpreted with some caution based on the long-term effects of programmes from the 1960s and 70s, which found that the short-term effects of more academic programmes wore off after a few years in primary 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 programmes. Hopefully, additional longitudinal studies will be conducted to determine the long-term impacts of the current programmes, 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 programmes. 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 primary school. At the same time, the cognitive-developmental approach emphasises 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 programmes 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 programme than teachers typically receive when implementing a new programme. In practice, teachers often receive very little support, perhaps just a teacher's manual with suggested activities. In some of the research studies summarised here, they received extensive initial training and very frequent follow-up coaching by the developer or researchers, which may not be typical when the programme 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 programmes require. Educational administrators need to plan and budget for this when adopting new programmes.

Second, researchers need to conduct research on educational programmes 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 the 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.

Of course the issue of the applicability of the findings of this review to the UK context must be addressed. All but one of the studies reviewed here were conducted in the US, many in large urban areas. However, the similarities of the challenges of large inner city communities in the US to those in the UK lead one to think that the findings would likely generalise to the UK. There is definitely a need for large-scale randomised evaluations of programmes already in use in the UK and of UK adaptations of programmes that have shown evidence of effectiveness in other countries. Of the 27 programmes with at least one study that qualified for this review we only found evidence that eight are available in the UK. Only one of these was rated as having strong evidence of effectiveness and one as having moderate evidence. More should be done to have promising programmes evaluated in the UK and, if found to be effective, disseminated here.

The findings of this review add to a growing body of evidence that early childhood programmes can have an important impact on increasing the school readiness of young children. There is a tremendous need for systematic, large-scale, longitudinal, randomised 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 primary school ready to succeed.

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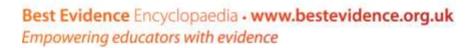
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Appendix A. Initial Search Strategy

EARLY CHILDHOOD EDUCATION

2. PROGRAMME NAMES + EARLY CHILDHOOD EDUCATION

(Broader search)

27/08/08 - 02/09/08

Limits:

No publication date limit applied

English language publications only

Records found (after deduplication): 1698

Records found (before deduplication): 1830

ERIC (Dialog DataStar) 1966 to date

Date searched: 27/08/08

Records found: 1557

1 highscope or high adj scope 354

2 creative adj curriculum 66

3 abecedarian 57

4 perry adj preschool 108

5 montessori 1173

6 reggio adj emilia 218

7 project adj approach 334

8 project adj construct 26

9 ellm 1

10 ladders adj literacy 10

11 dlm adj express 0

12 tools adj mind 12

13 open adj court 60

14 distar 138

15 child adj parent adj (center$ or centre$) 36

16 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 2451

17 early-childhood-education#.de. 55710

18 kindergarten.de. 8326

19 grade-1.de. or grade-2.de. 8355

20 nursery-schools.de. 722

21 child-care-centers.de. 273

22 child-development-centers.de. 322

23 early-intervention.de. 4580

24 ((intervention$ or education or program$1 or programme$1) adj young adj children).ti,ab. 1106

25 (young adj children adj (intervention$ or education or program$1 or programme$1)).ti,ab. 45

26 (early adj (years or childhood) adj (intervention$ or education or program$1 or programme$1)).ti,ab. 6218

27 (nursery adj school$1 or kindergarten$ or prekindergarten$).ti,ab. 16050

28 ((pre-natal$ or prenatal$ or pre adj natal or ante-natal or antenatal or ante adj natal) near (program$1 or programme$1 or education or intervention$)).ti,ab. 158

29 (preschool$ or preschool$ or pre adj school$).ti,ab. 20990

30 ((pre-birth or pre adj birth or prebirth or pregnancy or pregnant) near (program$1 or programme$1 or education or intervention$)).ti,ab. 689

31 young-children#.de. 35947

32 child-care.de. 1960

33 ((maternal or parenting or family or families) adj (program$1 or programme$1 or education)).ti,ab. 1587

34 (infant$ adj (program$1 or programme$1 or education)).ti,ab. 179

35 (first adj grade or second adj grade).ti,ab. 8354

36 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 97627

37 16 and 36 1557

PsycInfo (Ovid) 1806 - August Week 4 2008

Date searched: 01/09/08

Records found: 273

1. (highscope or (high adj scope)).ti,ab.

2. (creative adj curriculum).ti,ab.

3. abecedarian.ti,ab.

4. (perry adj preschool).ti,ab.

5. montessori.ti,ab.

6. (reggio adj emilia).ti,ab.

7. (project adj approach).ti,ab.

8. (project adj construct).ti,ab.

9. ellm.ti,ab.

10. (ladders adj literacy).ti,ab.

11. (dlm adj express).ti,ab.

12. (tools adj mind).ti,ab.

13. (open adj court).ti,ab.

14. distar.ti,ab.

15. (child adj parent adj (center$ or centre$)).ti,ab.

16. or/1-15

17. "early childhood programs".id.

18. preschool education/

19. kindergartens/

20. preschool students/ or nursery school students/ or kindergarten students/

21. nursery schools/

22. child day care/

23. early childhood development/ or infant development/

24. Early Intervention/

25. prenatal care/

26. ((intervention$ or education or program$) adj young adj children).ti,ab.

27. (young adj children adj (intervention$ or education or program$)).ti,ab.

28. (early adj (years or childhood) adj (intervention$ or education or program$)).ti,ab.

29. ((nursery adj school$) or kindergarten$ or prekindergarten$).ti,ab.

30. ((pre-natal$ or prenatal$ or (pre adj natal) or ante-natal or antenatal or (ante adj natal)) adj3 (program$ or education or intervention$)).ti,ab.

31. (preschool$ or preschool$ or (pre adj school$)).ti,ab.

32. ((pre-birth or (pre adj birth) or prebirth or pregnancy or pregnant) adj3 (program$ education or intervention$)).ti,ab.

33. ((maternal or parenting or family or families) adj (program$ or education)).ti,ab.

34. (infant$ adj (program$ or education)).ti,ab.

35. ((first adj grade) or (second adj grade)).ti,ab.

36. or/17-35

37. 16 and 36

38. limit 37 to english language