Effects of Preschool Curriculum Programs on School Readiness

Report from the Preschool Curriculum Evaluation Research Initiative




NCER 2008-2009
U.S. DEPARTMENT OF EDUCATION

ies NATIONAL CENTER FOR EDUCATION RESEARCH
Institute of Education Sciences

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[1] The members of the Preschool Curriculum Evaluation Research (PCER) Consortium include the principal investigators and co-principal investigators from each of the 12 funded research projects, Institute of Education Sciences (IES) staff, and staff from RTI International (RTI) and Mathematica Policy Research (MPR), Inc., the evaluation contractors.

[2] This University of California, Berkeley research team partnered with researchers at the University at Buffalo, State University of New York to evaluate the *Pre-K Mathematics supplemented with DLM Early Childhood Express Math software* curriculum in California and New York.

[3] This University of California, Berkeley research team evaluated the *Ready, Set, Leap!* curriculum in New Jersey.

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Acknowledgments

The findings reported here are based on research conducted by the Preschool Curriculum Evaluation Research (PCER) program research teams, the evaluation contractors, and Institute of Education Sciences (IES) staff. This report is a product of the collaborative efforts of the PCER Consortium. The PCER Consortium consists of research teams from each participating grantee site, IES staff, and the evaluation contractors: RTI International (RTI) and Mathematica Policy Research (MPR), Inc. Appendix B of the report was authored by Randall Bender (RTI), Jun Liu (RTI), Ina Wallace (RTI), Melissa Raspa (RTI), and Margaret Burchinal (University of North Carolina at Chapel Hill).

The PCER Consortium would like to acknowledge Dr. Susan J. Kontos who served as the principal investigator for the *Project Approach* (Wisconsin) evaluation study from July 2002 to September 2003. Dr. Kontos, one of the country's leading researchers in early childhood education and care, died September 12, 2003.

We also acknowledge and thank Heidi Schweingruber and James Griffin for their contributions to the PCER program during their tenure at IES.

We are grateful to the schools, teachers, parents, and the children who participated in our assessments, interviews, and observations. Without their cooperation, none of this research would have been possible.

The listed authors represent only a part of the research team involved in this project. We would like to thank the research staff at each grantee site, especially the grantees' site coordinators who worked closely with the local preschool programs, kindergarten school staff, and the contractors' data collection teams to facilitate the successful collection of child-, parent-, teacher-, and classroom-level data. We appreciate the efforts of the classroom observers and the child assessors who were critical to the successful completion of data collection at each research site. We are also grateful to the many contractor staff members who have worked on data collection and data analysis tasks over the duration of the study.

The mention of trade names, commercial products, or organizations in the description of the projects, or the reporting of study findings, does not imply endorsement by the U.S. Government.

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Disclosure of Potential Conflicts of Interest

The PCER Consortium consists of research teams (principal investigators and co-principal investigators from each grantee site), IES staff, and the evaluation contractors, Mathematica Policy Research (MPR), Inc. and RTI International (RTI). Most of the grantee research teams, IES staff, and contractor staff from MPR and RTI have no interests that could be affected by findings from the evaluation of the curricula that are highlighted in this report.

It is important to note that four of the PCER initiative research teams developed curricula that were implemented at their respective research sites. The Success for All Foundation (SFA) developed the *Curiosity Corner* curriculum, which was implemented in preschool classrooms in Florida, Kansas, and New Jersey. Dr. Christopher Lonigan and his colleagues at Florida State University developed the *Literacy Express* curriculum, which was implemented in public pre-kindergarten classrooms in Florida. Drs. Prentice Starkey and Alice Klein are the developers of the *Pre-K Mathematics* curriculum. Drs. Douglas Clements and Julie Sarama are the developers of the *DLM Early Childhood Express Math software*. The *Pre-K Mathematics* curriculum and the *DLM Early Childhood Express Math software* were implemented jointly in Head Start and public pre-kindergarten classrooms in California and New York. Drs. Cheryl Fountain, Madelaine Cosgrove, and Janice Wood are on staff at the Florida Institute of Education, University of North Florida, where the *Early Literacy and Learning Model* (*ELLM*) was developed. These researchers were selected to receive funding for their PCER research projects in a competitive grant application process. Each research team implemented its curriculum and conducted site-specific analyses examining the effects of these curricula on child outcomes. RTI and MPR, the evaluation study contractors, conducted independent evaluations of these and the other treatment curricula that were included in the PCER study. The developers/implementers of these curricula did not conduct the impact analyses that are summarized in this report. Members of the RTI data analysis team completed the impact analyses.

In addition to their role as developers and implementers, Drs. Starkey, Klein, Clements, Sarama, and Lonigan developed measures that were included in the PCER child assessment battery. Drs. Starkey and Klein developed a preschool mathematics assessment, the Child Math Assessment (CMA) that was adapted for use in the PCER evaluation study. The Child Math Assessment-Abbreviated (CMA-A) was added to the assessment battery as a measure of children's early mathematical knowledge and skills using manipulative materials. The *Building Blocks*, Shape Composition task was also included in the child assessment battery. This task was adapted from the *Building Blocks* assessment tool, which was developed by Clements, Sarama, and Liu. The Elision subtest from the Preschool Comprehensive Test of Phonological and Print Processing (Pre-CTOPPP) was used in the pre-kindergarten year of the evaluation study. Dr. Christopher Lonigan and his colleagues developed the Pre-CTOPPP, Elision subtest. The assessment was not commercially available at the time it was selected for inclusion in the study or during the data collection phase of the study. A revised version of the assessment became commercially available as the Test of Preschool Early Literacy (TOPEL) in January 2007, after the PCER data collection. Dr. Lonigan has a financial interest in the commercial version of this measure.

Dr. Susan Landry and her colleagues at the Center for Improving the Readiness of Children for Learning and Education (CIRCLE) developed one of the study's classroom observation measures and advised on the selection of the child assessments. CIRCLE staff also trained PCER data collection teams to collect classroom observation data using the Teacher Behavior Rating Scale (TBRS), but CIRCLE staff did not collect the data. CIRCLE staff scored the classroom observation data that were collected using the TBRS measure.

Data collection teams from MPR and RTI independently collected all of the data using the measures that are mentioned here. The data analysis team completed descriptive and impact analyses using the scored data. The developers of these measures had no direct role in the completion of the descriptive analyses or the impact analyses that are summarized in this report.

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Glossary

ACF—Administration for Children and Families

ANCOVA—Analysis of Covariance

Arnett—Arnett Caregiver Interaction Scale

CMA-A—Child Math Assessment-Abbreviated

control classrooms—Classrooms randomly assigned to the control condition. Classrooms where the prevailing or existing curriculum was in use during the course of the study

control curriculum—The prevailing/existing curriculum used by teachers in the control condition at each site

CTOPP—Comprehensive Test of Phonological Processing (CTOPP), Elision subtest

ECERS-R—Early Childhood Environment Rating Scale-Revised

ECLS-K—Early Childhood Longitudinal Study, Kindergarten cohort

ELLM—*Early Literacy and Learning Model*

FACES—Family and Child Experiences Survey

FSU—Florida State University

full-day—Preschool program where children spend at least 6 hours per day in the preschool classroom

GED—General Educational Development

grantee—Researcher funded by the Institute of Education Sciences, U.S. Department of Education, to conduct a site-specific study under the Preschool Curriculum Evaluation Research initiative. Grants were awarded to investigators at a single institution or to co-investigators at multiple institutions

half-day—Preschool program where children spend less than 6 hours per day

Head Start center—Preschool that is funded by the U.S. Administration for Children and Families Head Start Bureau

ICC—Intraclass correlation

IES—Institute of Education Sciences, U.S. Department of Education

LBS—Learning Behaviors Scale

MDE—Minimum Detectable Effects

MPR—Mathematica Policy Research, Inc

Glossary—Continued

MPR evaluation sites—Preschool Curriculum Evaluation Research research sites where Mathematica Policy Research, Inc. conducted data collection

PCER—Preschool Curriculum Evaluation Research

PLBS—Preschool Learning Behaviors Scale

PPVT—Peabody Picture Vocabulary Test, Third Edition (PPVT-III)

Pre-CTOPPP—Preschool Comprehensive Test of Phonological and Print Processing, Elision subtest

private pre-kindergarten—Preschool that is funded primarily through tuition or other nongovernmental source

public pre-kindergarten—Preschool that is part of a public school system or receives substantial public funding

random assignment—Determination by lottery under supervision of a researcher whether a study subject will be placed in one experimental group or another

randomized trial—Research study in which subjects are randomly assigned to receive or not receive interventions

research site—Collection of preschool programs/classrooms in a specific geographic location that were recruited by each grantee. Grantees implemented one or more preschool curricula at each research site

RTI—RTI International

RTI evaluation sites—PCER research sites where RTI International conducted data collection

SFA—*Success for All*

site/grantee site—The geographic location of the research sites

SSRS—Social Skills Rating System

SSRS Problem Behaviors—Social Skills Rating System, Problem Behaviors scale

SSRS Social Skills—Social Skills Rating System, Social Skills scale

TBRS—Teacher Behavior Rating Scale

TERA—Test of Early Reading Ability, Third Edition (TERA-3)

TOLD—Test of Language Development-Primary, Third Edition (TOLD-P:3)

treatment classroom—Classrooms randomly assigned to the treatment condition where an experimental curriculum was implemented and evaluated

Glossary—Continued

treatment curriculum—One of the 14 intervention curricula that were implemented in treatment classrooms

UNF—University of North Florida

WJ—Woodcock Johnson Achievement Test, 3rd Edition (WJ III)

WJ Applied Problems/WJ Applied Problems test—Woodcock Johnson Achievement Test, 3rd Edition (WJ III), Applied Problems Test

WJ Letter Word Identification/WJ Word Identification test—Woodcock Johnson Achievement Test, 3rd Edition (WJ III), Letter Word Identification Test

WJ Spelling/WJ Spelling test—Woodcock Johnson Achievement Test, 3rd Edition (WJ III), Spelling Test

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Executive Summary

A variety of preschool curricula is available and in widespread use, however, there is a lack of evidence from rigorous evaluations regarding the effects of these curricula on children's school readiness. The lack of such information is important as early childhood center-based programs have been a major, sometimes the sole, component of a number of federal and state efforts to improve young at-risk children's school readiness (e.g., Head Start, Even Start, public pre-kindergarten). In 2005, nearly half (47%) of all 3- to 5-year-old children from low-income families were enrolled in either part-day or full-day early childhood programs (U.S. Department of Education 2006).

In 2002, the Institute of Education Sciences (IES) began the Preschool Curriculum Evaluation Research (PCER) initiative to conduct rigorous efficacy evaluations of available preschool curricula. Twelve research teams implemented one or two curricula in preschool settings serving predominantly low-income children under an experimental design. For each team, preschools or classrooms were randomly assigned to the intervention curricula or control curricula and the children were followed from pre-kindergarten through kindergarten. IES contracted with RTI International (RTI) and Mathematica Policy Research (MPR) to evaluate the impact of each of the 14 curricula implemented using a common set of measures with the cohort of children beginning preschool in the summer-fall of 2003.

This report provides the individual results for each curriculum from the evaluations by RTI and MPR. Chapter 1 describes the PCER initiative and details the common elements of the evaluations including the experimental design, implementation, analysis, results, and findings. Chapters 2-13, respectively, provide greater detail on the individual evaluations of the curricula implemented by each research team including information on the curricula, the demographics of the site-specific samples, assignment, fidelity of implementation, and results. Appendix A presents results from a secondary analysis of the data. Appendix B provides greater detail regarding the data analyses conducted. Appendixes C and D provide additional information regarding the outcome measures.

Research Questions

The PCER initiative focused on the impact of the intervention curricula on students' reading and pre-reading, phonological awareness, early language, early mathematics knowledge, and behavior (including social skills and problem behaviors) at the end of pre-kindergarten and kindergarten. These domains of knowledge and skills are predictive of academic success in the early years of elementary school (Downer and Pianta 2006; Miles and Stipek 2006). As a result, the research questions for the initiative primarily concern student outcomes and also include classroom outcomes due to their potentially mediating or moderating roles. The research questions are:

1. What is the impact of each of the 14 preschool curricula on preschool students' early reading skills, phonological awareness, language development, early mathematical knowledge, and behavior?
2. What is the impact of each of the 14 preschool curricula on these outcomes for students at the end of kindergarten?
3. What is the impact of each of the 14 preschool curricula on preschool classroom quality, teacher-child interaction, and instructional practices?

Study Design

Under the PCER initiative, 12 research teams received peer-reviewed grants to implement one to two preschool curricula of their choosing under an experimental design. For each team's evaluation, preschool classrooms or programs were randomly assigned to use the treatment or control curricula. The treatment curricula included sufficient standardized training procedures and curriculum materials to be implemented in typical early childhood education settings. RTI and MPR evaluated the impact of each curriculum using a common set of measures. The curricula, corresponding research team, research site, and evaluator are listed in table A. Three teams each implemented two curricula. Two teams implemented the same curriculum, *Creative Curriculum*. Four teams had originally developed the curricula that they implemented (*Curiosity Corner*; *Literacy Express*, *Pre-K Mathematics supplemented with DLM Early Childhood Express Math software*, and *Early Literacy and Learning Model [ELLM])*. RTI evaluated eight curricula implemented by seven teams (including one curriculum that was evaluated by two teams) while MPR evaluated six curricula implemented by five teams. In sum, 14 curricula (one twice) were evaluated.

The 14 curricula were evaluated in comparison to the local control condition that, in general, was the local curriculum-as-usual. As a result, multiple curricula were used across the control sites and within some of the individual evaluations. These included teacher-developed nonspecific curricula with a focus on basic school readiness, district-developed curricula, and published curricula (some of which were implemented by other research teams). The control curricula are identified in the section on Findings by Curriculum at the end of the Executive Summary. As a result of the use of different control curricula among the evaluations, this report does not make cross-intervention comparisons.

Rather than one overall evaluation, the PCER study contains individual evaluations for each curriculum, for three reasons. First, each research team worked independently. Second, the selection of the intervention and the randomized assignment occurred at the team level. Third, different control curricula were used with each intervention curriculum.

Sample and Assignment to Condition

Preschool programs taking part in the evaluation of the curricula included Head Start centers, private child care centers, and public pre-kindergarten programs in urban, rural, and suburban locations. Each research team recruited interested local preschool programs. IES had set a funding priority on grant applications that addressed preschools serving children from low-income families, with the result that 88 percent of the preschools included were either Head Start centers or public pre-kindergarten programs, and half of the children's primary caregivers had a high school education or less. Programs agreed to the random assignment (by program or classroom) to a treatment curriculum or to local control conditions.

For each evaluated curriculum, table B indicates whether pre-kindergarten programs or classrooms were randomly assigned to treatment or control conditions, the number assigned to each, and the number of treatment and control students included in each evaluation. Three teams (implementing four curricula) randomly assigned pre-kindergarten programs, and the other nine teams randomly assigned classrooms. Three teams compared two curricula against a single set of control classrooms or programs. All but two teams (Purdue University and University of New Hampshire) used block random assignment.

Table A. The intervention curricula

Curriculum and publisher	Research team	Research site	Evaluator
Bright Beginnings (Charlotte-Mecklenburg Schools 2001)	Vanderbilt University	Tennessee	RTI
Creative Curriculum (Teaching Strategies, Inc. 2002)	Vanderbilt University	Tennessee	RTI
Creative Curriculum (Teaching Strategies, Inc. 2002)	University of North Carolina at Charlotte	North Carolina and Georgia	RTI
Creative Curriculum with Ladders to Literacy (Teaching Strategies, Inc. 2002; Paul H. Brookes Publishing Company 1998)	University of New Hampshire	New Hampshire	RTI
Curiosity Corner (Success for All Foundation, Inc. 2003)	Success for All Foundation	Florida, Kansas, New Jersey	MPR
DLM Early Childhood Express supplemented with Open Court Reading Pre-K (SRA/McGraw-Hill 2003)	Florida State University	Florida	MPR
Doors to Discovery (Wright Group/McGraw-Hill 2001)	University of Texas Health Science Center at Houston	Texas	RTI
Early Literacy and Learning Model (Florida Institute of Education and the University of North Florida 2002)	University of North Florida	Florida	RTI
Language-Focused Curriculum (Paul H. Brookes Publishing Company 1995)	University of Virginia	Virginia	MPR
Let's Begin with the Letter People (Abrams & Company 2000)	University of Texas Health Science Center at Houston	Texas	RTI
Literacy Express (Author: Lonigan and Farver 2002, unpublished)	Florida State University	Florida	MPR
Pre-K Mathematics supplemented with DLM Early Childhood Express Math software (Scott Foresman—Pre-K Mathematics 2002; SRA/McGraw-Hill—DLM Early Childhood Express Math software 2003)	University of California, Berkeley and University at Buffalo, State University of New York	California and New York	RTI
Project Approach (Ablex 1989)	Purdue University and University of WI-Milwaukee	Wisconsin	RTI
Project Construct (Missouri Department of Elementary and Secondary Education 1992)	University of Missouri-Columbia	Missouri	MPR
Ready, Set, Leap! (LeapFrog School House 2003)	University of California, Berkeley	New Jersey	MPR

NOTE: RTI: RTI International
MPR: Mathematica Policy Research, Inc.
SOURCE: The Preschool Curriculum Evaluation Research (PCER) Study.

Table B. Units of random assignment for evaluation of each curriculum

Research team	Curricula	Treatment sample	Control sample	Students
Vanderbilt University	*Bright Beginnings*	7 classrooms	7 classrooms	T: 103 C: 105 T: 101
	Creative Curriculum	7 classrooms		
University of North Carolina at Charlotte	*Creative Curriculum*	9 classrooms	9 classrooms	T: 97 C: 97
University of New Hampshire	*Creative Curriculum with Ladders to Literacy*	7 classrooms	7 classrooms	T: 62 C: 61
Success for All Foundation	*Curiosity Corner*	10 Pre-K programs	8 Pre-K programs	T: 105 C: 110
University of Texas Health Science Center at Houston	*Doors to Discovery*	14 classrooms	15 classrooms	T: 101 C: 96 T: 100
	Let's Begin with the Letter People	15 classrooms		
University of North Florida	*Early Literacy and Learning Model*	14 classrooms[1]	14 classrooms[1]	T: 137 C: 107
University of Virginia	*Language-Focused Curriculum*	7 classrooms	7 classrooms	T: 97 C: 98
Florida State University	*DLM Early Childhood Express with Open Court Reading Pre-K*	5 Pre-K programs	6 Pre-K programs	T: 101 C: 97 T: 99
	Literacy Express	6 Pre-K programs		
UC-Berkeley and University at Buffalo, State University of New York	*Pre-K Mathematics with DLM Early Childhood Express Math software*	20 classrooms	20 classrooms	T: 159 C: 157
Purdue University and University of WI-Milwaukee	*Project Approach*	7 classrooms	6 classrooms	T: 114 C: 90
University of Missouri-Columbia	*Project Construct*	10 Pre-K programs[1]	11 Pre-K programs[1]	T: 123 C: 108
University of California, Berkeley	*Ready, Set, Leap!*	18 classrooms	21 classrooms	T: 149 C: 137

[1] After one program or classroom attrited.

NOTE: T: Treatment Group
C: Control Group

Three research teams (Vanderbilt University, University of Texas Health Science Center at Houston, and Florida State University) have two treatment groups and a shared control group. When reading the "Students" column, the first "T" refers to the first curriculum in the same row, while the second "T" refers to the second curriculum in the same row. The "C" refers to the shared control group. For example, Vanderbilt University compared two curricula: *Bright Beginnings* (103 students) and *Creative Curriculum* (101 students) to a control curriculum (105 students).

SOURCE: The Preschool Curriculum Evaluation Research (PCER) Study.

The process of random assignment differed somewhat depending upon the evaluator. The seven research teams working with RTI were responsible for the random assignment at their sites; RTI monitored the process and tracked any changes. These teams had a pilot preschool implementation year starting in the fall of 2002. The randomization conducted in that year carried over, in most cases, to the actual evaluation begun in the 2003-04 school year. The five research teams working with MPR began implementing the curricula in the 2003-04 school year. In conjunction with the research teams, MPR conducted block random assignment for four teams. In addition, Florida State University (FSU) block randomly assigned pre-kindergarten programs to its two curricula and the control group.

The analyses included 2,911 children, 315 preschool classrooms, and 208 preschools. As noted above, the PCER study individually evaluates separate curriculum so no comparisons are made between all those included in the treatment condition and all those who were part of the control condition. Such comparisons are made for each evaluation's treatment and control groups in chapters 2 to 13.

On average, the students were age 4.6 years at the time of the baseline data collection in the fall of 2003 and age 6.1 years at the time of the kindergarten follow-up in the spring of 2005. Approximately half (51%) of the children were male. One-third were white non-Hispanic, 43 percent were African American, and 16 percent were Hispanic. Less than 7 percent had a disability. On average, the students' primary caregivers, most often their biological or adoptive mother, were age 32 years at the time of the fall 2003 data collection. Less than half (47%) were married and one-third were never married. Less than half attended or graduated from college (48%), one-third had a high school diploma or GED, and 19 percent did not complete high school. Half were employed full-time, 14 percent part-time, and 34 percent were unemployed.

Almost all the preschool teachers were female (98%) and the majority were White (54%), with one-third African-American. Two-thirds had at least a college degree. On average, they had 12 years of teaching experience and 8 years of experience teaching in pre-kindergarten settings. A majority (87%) of the preschool programs in which they taught were full-day programs. More than half (58%) were public pre-kindergartens, 31 percent were Head Start teachers, and child care teachers made up the remainder (12%). On average, teachers taught 15 students, with a child-staff ratio averaging 7.5 children per teacher.

The kindergarten teachers were also mostly female (98%) and White (74%), with 17 percent African-American. Almost all had at least a BA (97%) with 39 percent having a graduate degree. They averaged 15 years of teaching experience, with an average of 9 years teaching kindergarten. Ninety-three percent of the kindergarten classrooms were full-day and 92 percent of the students were enrolled in public schools. The average number of students per classroom was 20 children. Thirty-nine percent were enrolled in schools where more than 75 percent of the students were eligible for free or reduced-price lunch.

Measures

Twenty-seven measures were chosen to address the outcomes of interest regarding children's school readiness (reading, phonological awareness, language, mathematics, and behavior) and classroom conditions (classroom quality, teacher-child interaction, and instructional practices). Table C lists the measures used for each outcome, when they were collected, and through which instrument they were collected. Five major data collection instruments were used to collect the outcome measures and other student, school and family data: (1) a child assessment, (2) a teacher report, (3) classroom observation, (4) a teacher interview or questionnaire, and (5) a parent interview.

Child Assessment

The child assessment measured the student-level academic outcomes for the evaluation, beginning with a preschool pre-test in the fall of 2003 and post-tests near the end of preschool in the spring of 2004, and the

Table C. Outcomes and measures

Outcome	Measures	Times collected	Instrument
Reading	TERA	Pre-K: fall/spring, K: spring	Child assessment
	WJ Letter Word Identification	Pre-K: fall/spring, K: spring	
	WJ Spelling	Pre-K: fall/spring, K: spring	
Pre-kindergarten phonological awareness[1]	Pre-CTOPPP	Pre-K: fall/spring	Child assessment
Kindergarten phonological awareness[1]	CTOPP	K: spring	Child assessment
Language	PPVT	Pre-K: fall/spring, K: spring	Child assessment
	TOLD	Pre-K: fall/spring, K: spring	
Mathematics	WJ Applied Problems	Pre-K: fall/spring, K: spring	Child assessment
	CMA-A Mathematics Composite	Pre-K: fall/spring, K: spring	
	Shape Composition[2]	Pre-K: fall/spring, K: spring	
Pre-kindergarten behavior[1]	SSRS Social Skills	Pre-K: fall/spring	Teacher report
	SSRS Problem Behavior	Pre-K: fall/spring	
	PLBS	Pre-K: fall/spring	
Kindergarten behavior[1]	SSRS Social Skills	K: spring	Teacher report
	SSRS Problem Behavior	K: spring	
	LBS	K: spring	
Classroom quality	ECERS-R	Pre-K: fall/spring	Classroom observation
Teacher-child interaction	Arnett Detachment	Pre-K: fall/spring	Classroom observation
	Arnett Harshness	Pre-K: fall/spring	
	Arnett Permissiveness	Pre-K: fall/spring	
	Arnett Positive Interaction	Pre-K: fall/spring	
Literacy instruction	TBRS Written Expression	Pre-K: spring	Classroom observation
	TBRS Print and Letter Knowledge	Pre-K: spring	
Phonological instruction	TBRS Phonological Awareness	Pre-K: spring	Classroom observation
Language instruction	TBRS Book Reading	Pre-K: spring	Classroom observation
	TBRS Oral Language	Pre-K: spring	
Mathematics instruction	TBRS Math Concepts	Pre-K: spring	Classroom observation

[1] Pre-kindergarten and kindergarten measures are not on the same scale.
[2] Building Blocks, Shape Composition task
NOTE: Refer to the glossary for abbreviations of the measures.
SOURCE: The Preschool Curriculum Evaluation Research (PCER) Study.

end of kindergarten in the spring of 2005. Individually administered, the battery assessed beginning reading skills, phonological awareness, oral language development, and mathematical knowledge and skills. The measures regarding reading included the Test of Early Reading Ability (TERA) (Reid, Hresko, and Hammill 2001), the Woodcock Johnson (WJ) Letter Word Identification, and WJ Spelling (McGrew and Woodcock 2001). For phonological awareness, the measures were the Elision subtests of the Preschool Comprehensive Test of Phonologic and Print Processing and the Comprehensive Test of Phonological Processing for kindergarten (Pre-CTOPPP and CTOPP) (Wagner, Torgeson, and Rashotte 1999). For language, the

measures included the Peabody Picture Vocabulary Test (PPVT) (Dunn and Dunn 1997) and the Test of Language Development (TOLD) Grammatic Understanding subtest (Newcomer and Hammill 1997). For mathematics, the measures were the WJ Applied Problems (McGrew and Woodcock 2001), the Child Math Assessment-Abbreviated (CMA-A) Composite Score (Klein and Starkey 2002), and the Building Blocks' Shape Composition Task (unpublished).

Teacher Report of Child Behavior

Teacher reports provided the student-level behavior measures used in the evaluation. Preschool teachers gave pre-intervention ratings of child behaviors in the fall of 2003 and post-intervention ratings in the spring of 2004. They rated each child's behavior (social competence, behavior problems, and classroom performance) using three scales: the Social Skills Rating System (SSRS) Social Skills scale, the SSRS Problem Behaviors scale (Gresham and Elliott 1990), and the Preschool Learning Behaviors Scale (PLBS) (McDermott et al. 2000). Kindergarten teachers provided a longer-term post-intervention rating on the students' behavior in the spring of 2005 using the two SSRS scales and the Learning Behaviors Scale (LBS) (McDermott et al. 2000).

Classroom Observation

Two pre-intervention classroom measures and three post-intervention classroom measures were gathered from preschool classroom observations. No observations were made of kindergarten classrooms. Three scales designed to characterize the quality and organization of the classroom and the nature of the interaction between children and the teacher were used in the observations. The Early Childhood Environment Rating Scale-Revised (ECERS-R) (Harms, Clifford, and Cryer 1998) provided an overall measure of the quality of the classroom. The Arnett Caregiver Interaction Scale (Arnett) (Arnett 1989) measured teacher-child interaction on four scales: Positive Interaction, Harshness, Detachment, and Permissiveness. The pre-intervention observation using the ECERS-R and Arnett Scale was conducted in the fall of 2003 and the post-intervention observation in the spring of 2004. The Teacher Behavior Rating Scale (TBRS) (Landry et al. 2002) was added as a post-intervention measure to the spring 2004 observation to capture preschool instructional practices. The TBRS includes scales for teacher instructional practices regarding: written expression, print and letter knowledge, phonological awareness, book reading, oral language use, and mathematics concepts.

Teacher Interview/Questionnaire

Preschool teachers were interviewed regarding the types and frequency of classroom activities, general classroom information, clarification of observational data, teacher attitudes and beliefs, and teacher background information. The background information was used to construct covariates for the models used to analyze the data. Instead of an interview, kindergarten teachers completed a questionnaire that addressed their background, views on readiness, classroom resources and activities, instructional practices, and interactions with parents.

Parent Interview

Parents were interviewed regarding demographic information, their own and their child's health and disability status, their assessment of the child's accomplishments and social skills, family-child activities, parenting practices, parental depression, and the use of child care. The interview drew primarily from the Head Start's Family and Child Experiences Survey (FACES) (U.S. Department of Health and Human Services 2002) supplemented with additional measures. The demographic information and disability status were used to construct covariates for the models used to analyze the data.

Study Implementation

The key implementation events in the evaluation of each curriculum included randomization of classrooms or programs, consent gathering, teacher training in the use of a treatment curriculum, implementation of the curriculum in the classroom, training the assessors, and collection of the baseline student and classroom measures and the post-intervention measures in preschool and kindergarten. As research teams independently implemented the curricula and as the schools followed different calendars, the dates and sometimes the order of these events differed between teams and sites within teams.

Randomization for the seven teams working with RTI occurred in the pilot year (starting in the fall of 2002) and mostly carried over into the 2003-04 evaluation year. For the five teams working with MPR, there was no pilot year and their time of randomization ranged from July through September of 2003.

The consent process followed randomization, except for two teams, for which it occurred concurrently. The start of implementation of the curricula in the classroom ranged from August through October 2003. The RTI and MPR data collection teams attempted to collect baseline data close to the beginning of school to avoid student exposure to the treatment curricula before pre-testing. Twelve teams began implementation before baseline data collection and two teams began implementation concurrently with collection. The lag between the start of implementation and the collection of baseline data ranged from 8 to 49 days (appendix A discusses additional analyses to adjust for possible early treatment effects that might result from these cases). Baseline data collection followed the consent process for the teams working with MPR and ran concurrently for the teams working with RTI. Baseline data collection took 6 to 8 weeks between September and November 2003. Assessors were trained the week of August 4, 2003 for the teams working with RTI and the week of September 8, 2003 for the teams working with MPR.

The amount and timing of teacher training varied by team. The teams working with RTI provided most of the training during the 2002 pilot year, then gave refresher training during the 2003 evaluation year. The teams working with MPR provided initial training at the beginning of the evaluation year, and then follow-up training throughout the year. The students' exposure to the treatment curriculum and their teachers' training in its use was confined to preschool for all teams except in the case of the Success for All (SFA) team; in this case, some children entered SFA kindergarten classrooms where the SFA *Kinder Corner*s curriculum was in use.

Pre-kindergarten post-test data were collected in the spring, from April to June 2004, depending on school calendars. Student assessments, teacher interviews, teacher reports on behavior, and classroom observations were completed over a 6- to 8-week period. Parent interviews were completed over a 12-week period. Kindergarten post-test data (student assessments, teacher reports, teacher surveys, and parent interviews but no classroom observations) were collected in the spring and summer of 2005 between March and July.

Fidelity of Implementation

The research teams collected data on the fidelity of implementation for the treatment and control curricula using both a team-specific measure and a global implementation rating that can be used for between-curricula comparisons. The global ratings use a four-point scale representing High, Medium, Low, or No Implementation. The fidelity of implementation for both the treatment and control curricula was rated as Medium.

Contamination

The research teams monitored treatment and control classrooms to ensure that treatment group teachers were not sharing curriculum information or materials with teachers in the control group. At research sites with classroom-level random assignment to the treatment and control groups (treatment and control classrooms in the same school or center), the teams' classroom observations indicated that there was little or

no evidence of contamination. There was minimal risk of contamination at sites where pre-kindergarten programs (child care, Head Start centers, or all pre-kindergarten classrooms in an elementary school) were randomly assigned to the treatment or control condition.

Response Rates and Attrition

The baseline data were collected in fall 2003 from the original sample, with an average response rate of 98 percent for the child assessments, 97 percent for the teacher reports, and 84 percent for the parent interviews. For the first follow-up data collection in spring 2004, attrition reduced the percentage of children for whom data were collected to 93 percent of students completing the child assessments, 90 percent having a teacher report, and 79 percent having a parent interview. Further attrition led to an additional decline in the second follow-up data collection in spring 2005, with 85 percent of the original sample completing the child assessments, 72 percent having a teacher report, and 75 percent having a parent interview. Overall, 15 percent of all the students sampled (426 students) were not included in the analyses: 2 percent non-responders during baseline data collection and 13 percent through later attrition. For the individual research teams, the percentage of students sampled who were not included in the analysis ranged from 3 to 34 percent. There was no evidence of differential sample attrition across the treatment and control groups at each research site.

Analysis

Each curriculum was analyzed separately due to the independence of the research teams, the nonrandom assignment of curricula to research teams and sites, and the differences in control conditions. Because students were nested in classrooms or programs and repeatedly assessed with multiple measures, multi-level models containing a series of student, teacher, and classroom-level covariates were used to address the cross-level correlated errors, allowing for a mixture of random and fixed effects (see appendix B for details). For each curriculum, these models were used to estimate differences between treatment and control group means for each of the 27 outcome measures. The type of model used to analyze each outcome measure depended on the number of time points it was observed.

Two types of models for repeated measures (spline and simple) were used for outcome measures with comparable data from two or three time points. Analysis of covariance (ANCOVA) was conducted for outcome measures observed at one time point. The more observations of a measure from different time points included in a model, the better able the model is to identify the parameters of interest, in this case the treatment and control group means of the measures. For this reason, the spline repeated measures model is the preferred model followed by the simple repeated measures model, and then the ANCOVA. The analysis of each measure uses the most preferred model that can be used given the number of time points the measure was observed. Table D lists the model used with each measure.

For the eight student-level outcome measures with observations at three time points, a repeated measures spline model was used to compare the treatment and control group means for the spring pre-kindergarten and spring kindergarten observations. In addition, the model was used to check for differences in group mean measures at the baseline observation, check for such differences at the start of treatment if there was a lag between curriculum implementation and the baseline data collection, and compare the mean rates of growth for the treatment and control groups in pre-kindergarten and in kindergarten (the statistical techniques used are discussed in appendix B and the results from these three analyses are provided in appendix A). For the four student-level outcome measures and five classroom-level outcome measures with observations at two time points, a simple repeated measures model was used to compare the treatment and control group means at spring pre-kindergarten. Similarly, it was used to check on group mean differences at the baseline and start of treatment, and compare the rates of growth in pre-kindergarten.

Table D. Model used with each measure

Outcome	Measure	Times observed	Model
Reading	TERA	3	Spline repeated measures
	WJ Letter Word Identification	3	Spline repeated measures
	WJ Spelling	3	Spline repeated measures
Pre-kindergarten phonological awareness[1]	Pre-CTOPPP	2	Repeated measures
Kindergarten phonological awareness[1]	CTOPP	1	ANCOVA w/ Pre-K baseline
Language	PPVT	3	Spline repeated measures
	TOLD	3	Spline repeated measures
Mathematics	WJ Applied Problems	3	Spline repeated measures
	CMA-A Mathematics Composite	3	Spline repeated measures
	Shape Composition[2]	3	Spline repeated measures
Pre-kindergarten behavior[1]	SSRS Social Skills	2	Repeated measures
	SSRS Problem Behavior	2	Repeated measures
	PLBS	2	Repeated measures
Kindergarten behavior[1]	SSRS Social Skills	1	ANCOVA w/ Pre-K baseline
	SSRS Problem Behavior	1	ANCOVA w/ Pre-K baseline
	LBS	1	ANCOVA w/ Pre-K baseline
Classroom quality	ECERS-R	2	Repeated measures
Teacher-child interaction	Arnett Detachment	2	Repeated measures
	Arnett Harshness	2	Repeated measures
	Arnett Permissiveness	2	Repeated measures
	Arnett Positive Interaction	2	Repeated measures
Literacy instruction	TBRS Written Expression	1	ANCOVA
	TBRS Print and Letter Knowledge	1	ANCOVA
Phonological instruction	TBRS Phonological Awareness	1	ANCOVA
Language instruction	TBRS Book Reading	1	ANCOVA
	TBRS Oral Language	1	ANCOVA
Mathematics instruction	TBRS Math Concepts	1	ANCOVA

[1] Pre-kindergarten and kindergarten measures are not on the same scale.
[2] Building Blocks, Shape Composition task
NOTE: ANCOVA: Analysis of covariance. The repeated measures spline model was used to analyze data collected at three time points (fall and spring of pre-kindergarten and spring of kindergarten). The simple repeated measures model was used to analyze data collected at two time points (fall and spring of pre-kindergarten). Refer to the glossary for abbreviations of the measures.
SOURCE: The Preschool Curriculum Evaluation Research (PCER) Study.

ANCOVA models were used to estimate the difference in mean outcome measures between the treatment and control group in the spring of pre-kindergarten or kindergarten when only one observation was available. The availability of only one observation of a measure occurred in two situations. First, four of the kindergarten student measures (the CTOPP, SSRS Social Skills, SSRS Problem Behaviors, and LBS) were not on the same scales as the pre-kindergarten measures. The ANCOVA model for these kindergarten measures included students' scores on the respective pre-kindergarten scale as a covariate to address any differences in the groups that occurred, despite randomization. Second, six pre-kindergarten classroom instruction measures were based on the TBRS that was given only in the spring of pre-kindergarten. Group mean differences for these were estimated using an ANCOVA without a similar baseline covariate. These models may be biased by any initial differences in instruction that may have existed despite randomization, as there is no baseline measure.

Results

The goal of the PCER initiative was to identify the impact of the 14 preschool curricula on five student-level outcomes (reading, phonological awareness, language, mathematics, and behavior) and six classroom-level outcomes (classroom quality, teacher-child interaction, and four types of instruction). Each outcome was based on one or more of the measures (see table D); thus, the process of determining a curriculum's impact on the outcomes required two steps. First, the models were estimated to identify average differences in the 27 measures between the students receiving the treatment curriculum and those receiving the control and determine whether they were statistically significant. Second, criteria were applied to the set of measures that made up each outcome to determine whether the results for that group of measures showed a finding that the curriculum had an impact on that outcome. This process is described in the following order: (1) the model results for the 27 measures, (2) the criteria applied to the measures for each outcome, and (3) the findings derived from applying the criteria to the results for the measures.

The analysis tested the statistical significance of the difference between the means of the treatment versus the control group for each measure. Tables E-G display this difference as an effect size and note which differences are statistically significant (using a significance level of .05 and a two-tailed test). In the tables, the measures are grouped under their corresponding student-level and classroom-level outcomes. Table E identifies the impacts of each curriculum on the student-level measures in pre-kindergarten (note that *Creative Curriculum* is listed twice as it was implemented by the Vanderbilt University (Tennessee) research team and by the University of North Carolina at Charlotte (North Carolina) research team). Ten curricula show no statistically significant impacts on any of the student-level measures while five show significant impacts on some measures. Table F identifies nine curricula showing no statistically significant impacts on any of the student-level measures in kindergarten and six that do. Table G shows that with seven curricula there are no statistically significant impacts on any of the classroom-level measures and eight curricula show such impacts.

Table E. Effect sizes for student-level measures: Pre-kindergarten

	Curricula														
Outcome/Measures	**BB**	**CC (V)**	**CC (UNC)**	**CC with Ldrs**	**Curiosity Corner**	**DD**	**LB**	**ELLM**	**LFC**	**DLM with OC**	**LE**	**Pre-K Math**	**PA**	**PC**	**RSL**
Reading															
TERA	.39*	.02	-.08	-.30	.10	.06	.02	.15	.16	.68***	.17	.13	.14	.00	.08
WJ Letter Word Identification	.35	.16	-.08	-.16	.09	.10	.10	-.05	.11	.51**	.30	-.01	.42	-.05	.01
WJ Spelling	.18	.19	-.18	.30	.04	.06	.17	.11	.25	.46**	.05	.20	27	-.15	.20
Phonological awareness															
Pre-CTOPPP	-.07	.10	.02	-.16	.18	.18	-.13	.18	.20	.32*	.14	.04	.05	.10	-.09
Language															
PPVT	.13	.23	.08	-.38	-.01	.15	-.03	.17	.02	.40*	.17	.17	.16	.03	.15
TOLD	.09	.07	-.16	-.22	-.08	.17	.08	.15	.01	.40**	-.04	.17	.15	-.05	-.11
Mathematics															
WJ Applied Problems	.16	.17	.20	-.14	.10	.01	-.10	.10	.20	.36**	.05	.22	.07	.06	.04
CMA-A Mathematics Composite	.14	.10	-.10	.18	.01	.13	.15	.01	.08	.17	-.02	.44**	.18	-.11	-.24*
Shape Composite	-.03	.12	.19	.02	.16	-.13	21	-.14	.08	.24	-.01	.96***	.27	-.42**	.08
Behavior															
SSRS Social Skills	-.27	.03	.05	-.25	-.06	-.18	-.27	-.06	-.42	-.11	-.06	.22	.04	.22	-.05
SSRS Problem Behavior	.23	.07	-.16	-.01	.43	-.14	-.06	-.24	.37	.11	-.31	-.09	.50	-.08	-.03
PLBS	.04	.14	.07	-.08	-.25	-.18	-.44	.14	-.27	-.16	17	.09	-.31	.00	.07

* $p < .05$; ** $p < .01$; *** $p < .001$

NOTE: Refer to the glossary for abbreviations of the measures. Abbreviations for the curricula are:

BB: *Bright Beginnings*
CC (V): *Creative Curriculum* (Vanderbilt University)
CC (UNC): *Creative Curriculum* (University of North Carolina at Charlotte)
CC with Ldrs: *Creative Curriculum with Ladders to Literacy*
DD: *Doors to Discovery*
LB: *Let's Begin with the Letter People*
ELLM: *Early Literacy and Learning Model*
LFC: *Language-Focused Curriculum*
DLM with OC: *DLM Early Childhood Express supplemented with Open Court Reading Pre-K*
LE: *Literacy Express*
Pre-K Math: *Pre-K Mathematics supplemented with DLM Early Childhood Express Math software*
PA: *Project Approach*
PC: *Project Construct*
RSL: *Ready, Set, Leap!*

SOURCE: The Preschool Curriculum Evaluation Research (PCER) Study.

Table F. Effect sizes for student-level measures: Kindergarten

	Curricula														
Outcome/Measures	**BB**	**CC (V)**	**CC (UNC)**	**CC with Ldrs**	**Curiosity Corner**	**DD**	**LB**	**ELLM**	**LFC**	**DLM with OC**	**LE**	**Pre-K Math**	**PA**	**PC**	**RSL**
Reading															
TERA	-.07	.10	-.04	-.54	.43*	-.05	-.13	.30	.05	.76**	-.11	.31	.29	-.03	.01
WJ Letter Word Identification	.09	.38	.00	-.27	.43*	-.09	-.18	.00	.02	.50**	.08	.22	.03	.16	-.12
WJ Spelling	.06	.25	-.05	-.08	.20	-.12	-.06	.04	.11	.22	.06	.03	.14	.00	.04
Phonological awareness															
CTOPP	.01	.06	.06	-.10	.25	-.09	-.13	.08	.03	.38*	.08	-.11	-.17	-.12	-.02
Language															
PPVT	.07	.12	.15	-.30	.14	.18	.00	.34*	-.09	.48**	.16	.11	.10	.10	-.02
TOLD	.16	.11	-.17	-.06	.15	.06	-.12	.44**	-.07	.46**	.10	.08	.32	.01	-.03
Mathematics															
WJ Applied Problems	.13	.17	.09	-.33	.26	-.02	-.13	.26	.11	.48***	-.02	.13	.27	.08	.00
CMA-A Mathematics Composite	.07	.05	.14	-.19	-.05	-.16	-.07	-.05	.00	.13	-.21	.13	.22	-.06	-.10
Shape Composite	.15	.00	-.01	-.10	.32	-.12	-.06	.03	.06	.09	-.14	.41***	.24	.12	.03
Behavior															
SSRS Social Skills	.03	.35	-.12	.17	.32	-.05	.24	.27	-.07	-.18	-.37	.06	-.44*	.12	-.03
SSRS Problem Behavior	.24	-.05	.08	.02	-.08	.46	.06	.23	-.05	.01	.22	-.01	.49*	.07	.07
LBS	.30	.08	-.20	-.11	.11	-.32	-.10	.04	.10	-.13	-.38*	.01	-.42*	-.02	-.01

* $p < .05$; ** $p < .01$; *** $p < .001$

NOTE: Refer to the glossary for abbreviations of the measures. Abbreviations for the curricula are:

BB: *Bright Beginnings*
CC (V): *Creative Curriculum* (Vanderbilt University)
CC (UNC): *Creative Curriculum* (University of North Carolina at Charlotte)
CC with Ldrs: *Creative Curriculum with Ladders to Literacy*
DD: *Doors to Discovery*
LB: *Let's Begin with the Letter People*
ELLM: *Early Literacy and Learning Model*
LFC: *Language-Focused Curriculum*
DLM with OC: *DLM Early Childhood Express supplemented with Open Court Reading Pre-K*
LE: *Literacy Express*
Pre-K Math: *Pre-K Mathematics supplemented with DLM Early Childhood Express Math software*
PA: *Project Approach*
PC: *Project Construct*
RSL: *Ready, Set, Leap!*

SOURCE: The Preschool Curriculum Evaluation Research (PCER) Study.

Table G. Effect sizes for classroom-level measures: Pre-kindergarten

	Curricula														
Outcome/Measure	BB	CC (V)	CC (UNC)	CC with Ldrs	Curiosity Corner	DD	LB	ELLM	LFC	DLM with OC	LE	Pre-K Math	PA	PC	RSL
Global classroom quality															
ECERS-R	.80	.45	1.66*	-.71	-.48	.39	.82*	-.48	—	.34	1.29*	.05	-.19	.54	.16
Teacher-child interaction															
Arnett Detachment	.19	-.16	-1.68*	.51	-.41	-.07	-.07	-.41	—	-.06	-1.09	-.37	.57	.12	.19
Arnett Harshness	.12	-.12	-.70	-.26	.14	-.38	-.95*	-.40	—	-.70	-.84	.18	.86	-.13	.30
Arnett Permissiveness	.16	.51	-1.01	1.02	-.98	.13	-.05	-.24	—	.05	.51	-.45	-.43	-.02	-.24
Arnett Positive Interactions	.41	-.15	1.65**	.03	.02	.38	.48	.29	—	.43	.56	.16	-.99	.46	.04
Language instruction															
TBRS Book Reading	1.03	-.47	.28	-.32	2.06**	1.18*	.63	.32	-.79	.01	.49	.07	-.76	.81	-.18
TBRS Oral Language	.39	-.07	1.80**	-.50	.37	.59	.44	.14	.87	-.33	.25	.19	-.42	.52	-.24
Phonological instruction															
TBRS Phonological Awareness	1.53*	1.97	-.10	-.19	.44	.58	.66	.53	.92	1.41*	1.26*	.38	-1.19	.01	.22
Literacy instruction															
TBRS Print and Letter Knowledge	1.51*	1.81	1.02	.75	-.99	.90*	.99*	.41	.33	.91	1.07	.07	.34	.34	-.02
TBRS Written Expression	1.61*	1.99	1.73**	1.13*	-.54	.62	.60	-.22	.99	-.58	-.03	-.12	.62	.43	.10
Mathematics instruction															
TBRS Math Concepts	.98	1.48	.75	.44	-.33	.37	.24	-.92	.20	-.46	-.12	.57	-.64	.53	-.10

— Not available.

* $p < .05$; ** $p < .01$

NOTE: Refer to the glossary for abbreviations of the measures. Abbreviations for the curricula are:

BB: *Bright Beginnings*
CC (V): *Creative Curriculum* (Vanderbilt University)
CC (UNC): *Creative Curriculum* (University of North Carolina at Charlotte)
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PA: *Project Approach*
PC: *Project Construct*
RSL: *Ready, Set, Leap!*

SOURCE: The Preschool Curriculum Evaluation Research (PCER) Study.

The statistical significance of these results depend, in part, upon the evaluations having adequate power to detect significant impacts. The original IES Request for Applications to which the 12 research teams successfully responded required that each team include a minimum of 10 classrooms or preschool programs (half treatment and half control) with a minimum of 150 total students. Minimal Detectable Effects were calculated after data collection using the smaller achieved (not expected) samples for each team on a set of four composite measures (combining the measures for reading, language, mathematics and behavior respectively). The Minimal Detectable Effects ranged from .34 to .69 across the composites and teams.

Four of the five student-level outcomes had two to three outcome measures associated with them (phonological awareness only had one per grade), as did three of the six classroom-level outcomes. The measures within an outcome are conceptually related to one another and sufficiently inter-correlated that an effect on one would not be expected to appear, except by chance, without indications of some effect on the others. To minimize the potential for false positive findings that may arise from multiple comparisons made among related measures, a criterion was applied to the set of measures within each outcome (rather than a post-hoc statistical adjustment). These criteria were used to determine whether a curriculum had a treatment effect on each student-level outcome for pre-kindergarten and for kindergarten. They include:

- The reading, mathematics, and behavior outcomes each contained three measures. The finding that a curriculum has an effect on any of these three outcomes required at least two of the three measures to have had a statistically significant effect with the same sign and no significant effect with the opposite sign.
- The language outcome contained two measures. A finding of an outcome effect required at least one of the two measures to have had a statistically significant effect and no significant effect with the opposite sign.
- The phonological awareness outcome contained one measure. A finding of an outcome effect required this measure (Pre-CTOPPP in preschool and CTOPP in kindergarten) to have had a statistically significant effect.

A similar set of rules was used to determine whether a curriculum had a treatment effect on each pre-kindergarten classroom-level outcome:

- The classroom-quality outcome contained one measure. A finding of an outcome effect required this measure to have had a statistically significant effect.
- The teacher-child relationship outcome contained four measures. A finding of an outcome effect required at least two of the four measures to have had a statistically significant effect in the same direction and no statistically significant effects with the opposite direction. For these measures, direction concerns desirability of the effect; a desirable effect would be a positive sign for the Positive Interaction scale and a negative effect for the other three scales.
- The early literacy instruction outcome and the early language instruction outcome each contained two measures. A finding of an outcome effect required at least one of the two measures to have had a statistically significant effect and no significant effect with the opposite sign.
- The phonological instruction outcome and the mathematics instruction outcome each contained one measure. A finding of an outcome effect required the measure to have had a statistically significant effect.

These criteria were applied to the results for each set of measures within the five student-level outcomes (for preschool and for kindergarten) and the six classroom-level outcomes for kindergarten presented in tables E-G. In this way, each curriculum's impact on each of the 16 outcomes was determined. Below, these findings are presented in two sections: the first organized by outcome and the second by curriculum. Under the Findings by Outcome, those curricula affecting each of the five student-level (for pre-kindergarten and

kindergarten) and six classroom-level outcomes (for pre-kindergarten) are identified. Under the Findings by Curriculum, each curriculum is discussed with regard to its effects on the outcomes.

The findings described in both sections are presented in tables H and I. Table H shows the impacts of each curriculum on the student-level outcomes for both pre-kindergarten (pre-K) and kindergarten (K). A blank cell stands for no effect, a plus sign (+) means a positive effect, a minus sign (-) means a negative effect, and a zero (0) signifies no effect in one grade when there is an effect in the other. Table I shows the impact of each curriculum on the classroom-level outcomes using the same symbols.

Findings by Outcome

Two of the 14 intervention curricula had impacts on the student-level outcomes for the pre-kindergarten year (table H). *DLM Early Childhood Express supplemented with Open Court Reading Pre-K* positively affected reading, phonological awareness, and language. *Pre-K Mathematics supplemented with DLM Early Childhood Express Math software* curricula positively affected mathematics.

In the kindergarten year, four of the curricula had impacts on the student-level outcomes though three of these did not have impacts during the pre-kindergarten year (table H). *DLM Early Childhood Express supplemented with Open Court Reading Pre-K* continued to have positive effects on reading, phonological awareness, and language in kindergarten as it did in pre-kindergarten. *Curiosity Corner*, which had no effects in pre-kindergarten, was found to positively affect reading in kindergarten. *Early Literacy and Learning Model (ELLM)*, which had no effects in pre-kindergarten, was found to positively affect language in kindergarten. *Project Approach*, which had no effects in pre-kindergarten, was found to negatively affect behavior in kindergarten.

Eight of the 14 treatment curricula had a positive effect on the pre-kindergarten classroom-level outcomes (table I). *Bright Beginnings* affected early literacy instruction and phonological awareness instruction. *Creative Curriculum* (as implemented by the North Carolina team but not by the Tennessee research team) affected classroom quality, teacher-child interaction, early literacy instruction and early language instruction. *Creative Curriculum with Ladders to Literacy* affected early literacy instruction. *Curiosity Corner* affected early language instruction. *DLM Early Childhood Express supplemented with Open Court Reading Pre-K* affected phonological awareness instruction. *Doors to Discovery* affected early literacy instruction and early language instruction. *Let's Begin with the Letter People* affected classroom quality and early literacy instruction. *Literacy Express* affected classroom quality and phonological awareness instruction.

Findings by Curriculum

Each curriculum is discussed separately and cross-curriculum comparisons are not made. The type of pre-kindergarten program involved in the evaluation and the control curricula are described (though the results should not be used to evaluate any control curricula). Impacts on the outcomes are then presented in the following order: (1) student-level outcomes in pre-kindergarten, (2) student-level outcomes in kindergarten, and (3) classroom-level outcomes in pre-kindergarten.

Bright Beginnings

Bright Beginnings and its control were implemented in state pre-kindergarten classrooms in Tennessee. In the control classrooms, teachers used teacher-developed curricula with a focus on basic school readiness. No impacts on the pre-kindergarten or kindergarten student-level outcomes were found. A positive impact was found at the classroom level on early literacy instruction and phonological awareness instruction.

Table H. Findings by student-level outcomes

Curricula	Reading	Phonological awareness	Language	Mathematics	Behavior
Bright Beginnings					
Creative Curriculum (Vanderbilt)					
Creative Curriculum (UNC-Charlotte)					
Creative Curriculum with Ladders to Literacy					
Curiosity Corner	Pre-K: 0 K: +				
DLM Early Childhood Express with Open Court Reading Pre-K	Pre-K: + K: +	Pre-K: + K: +	Pre-K: + K: +		
Doors to Discovery					
Early Literacy and Learning Model			Pre-K: 0 K: +		
Language-Focused Curriculum					
Let's Begin with the Letter People					
Literacy Express					
Pre-K Mathematics with DLM Early Childhood Express Math software				Pre-K: + K: 0	
Project Approach					Pre-K: 0 K: -
Project Construct					
Ready, Set, Leap!					

NOTE: Abbreviations of the findings are:
Pre-K: Pre-kindergarten
K: Kindergarten
+: Finding of a positive impact
-: Finding of a negative impact
Blank Cell: Finding of no impact
0: Finding of no impact (when an impact is found for the other grade)
SOURCE: The Preschool Curriculum Evaluation Research (PCER) Study.

Creative Curriculum—Vanderbilt University

Creative Curriculum and its control were implemented in state pre-kindergarten classrooms in Tennessee. In the control classrooms, teachers used teacher-developed curricula with a focus on basic school readiness. No impacts regarding pre-kindergarten or kindergarten student-level outcomes were found. No impacts were found on the classroom-level outcomes.

Table I. Findings by classroom-level outcomes

Curricula	Classroom quality	Teacher-child interaction	Early literacy instruction	Phonological awareness instruction	Early language instruction	Math concepts instruction
Bright Beginnings			+	+		
Creative Curriculum (Vanderbilt)						
Creative Curriculum (UNC-Charlotte)	+	+	+		+	
Creative Curriculum with Ladders to Literacy			+			
Curiosity Corner					+	
DLM Early Childhood Express with Open Court Reading Pre-K				+		
Doors to Discovery			+		+	
Early Literacy and Learning Model						
Language-Focused Curriculum						
Let's Begin with the Letter People	+		+			
Literacy Express	+			+		
Pre-K Mathematics with DLM Early Childhood Express Math software						
Project Approach						
Project Construct						
Ready, Set, Leap!						

NOTE: Abbreviations of the findings are:
+: Finding of a positive impact
Blank Cell: Finding of no impact
SOURCE: The Preschool Curriculum Evaluation Research (PCER) Study.

Creative Curriculum—University of North Carolina at Charlotte

Creative Curriculum and its control were implemented in full-day Head Start programs in North Carolina and Georgia. In the control condition, teachers used teacher-developed, nonspecific curricula. No impacts on the pre-kindergarten or kindergarten student-level outcomes were found. A positive impact was found at the classroom level on overall classroom quality, teacher-child relationships, early literacy instruction, and early language instruction.

Creative Curriculum with Ladders to Literacy

Ladders to Literacy was implemented in full-day and half-day Head Start classrooms in New Hampshire as a supplementary curriculum in conjunction with *Creative Curriculum*. In the control condition, teachers used only *Creative Curriculum*. No impacts on the pre-kindergarten or kindergarten student-level outcomes were found. A positive impact was found at the classroom level on early literacy instruction.

Curiosity Corner

Curiosity Corner and its control were implemented in full-day preschool programs in three different states (Florida, Kansas, and New Jersey). In the control condition, teachers used a variety of preschool curricula including the *Creative Curriculum* and *Animated Literacy* curriculum models, and teacher-developed curricula. No impacts regarding pre-kindergarten student-level outcomes were found. A positive impact on reading was found at the end of kindergarten. A positive impact was found at the classroom level on early language instruction.

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

The evaluation of *DLM Early Childhood Express supplemented with Open Court Reading Pre-K* took place in public pre-kindergarten classrooms in Florida. In the control condition, teachers were provided with the *High/Scope* curriculum. A positive impact was found on reading, phonological awareness, and language development in both pre-kindergarten and kindergarten. A positive impact was found at the classroom level on phonological awareness instruction.

Doors to Discovery

Doors to Discovery and its control were implemented in full-day Head Start and public pre-kindergarten (Title I and non-Title I) programs in Texas. In the control condition, teachers used teacher-developed, nonspecific curricula. No impacts on the pre-kindergarten or kindergarten student-level outcomes were found. A positive impact was found at the classroom level on early literacy instruction and early language instruction.

Early Literacy and Learning Model (ELLM)

The *Early Literacy and Learning Model (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 impacts regarding pre-kindergarten student-level outcomes were found. A positive impact on language development was found at the end of kindergarten. No impacts were found on the classroom-level outcomes.

Language-Focused Curriculum

The *Language-Focused* curriculum was implemented in full-day Head Start and public pre-kindergarten classrooms in Virginia. The control teachers reported using High/Scope curriculum materials. No impacts on the pre-kindergarten or kindergarten student-level outcomes were found. No impacts were found on the classroom instruction outcomes. Impacts on classroom quality and teacher-child interaction outcomes could not be determined because of unreliable (inflated) data from 8 of the 14 participating classrooms on the relevant measures.

Let's Begin with the Letter People

Let's Begin with the Letter People and its control were implemented in full-day Head Start and public pre-kindergarten (Title I and non-Title I) programs in Texas. In the control condition, teachers used teacher-developed, nonspecific curricula. No impacts on the pre-kindergarten or kindergarten student-level outcomes were found. A positive impact was found at the classroom level on classroom quality and early literacy instruction.

Literacy Express

Literacy Express and its control were implemented in public pre-kindergarten classrooms in Florida. In the control condition, teachers were provided with the *High/Scope* curriculum. No impacts on the pre-kindergarten or kindergarten student-level outcomes were found. A positive impact was found at the classroom level on classroom quality and phonological awareness instruction.

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

The evaluation of *Pre-K Mathematics supplemented with DLM Early Childhood Express Math software* took place in Head Start and public pre-kindergarten classrooms in California and New York. Several curricula were used

in the control condition including *Creative Curriculum*, *High/Scope, Montessori*, specialized literacy curricula, and local school district and teacher-developed curricula. A positive impact was found on students' mathematical knowledge at the end of pre-kindergarten. No impacts on the kindergarten student-level outcomes were found. No impacts were found on the classroom-level outcomes.

Project Approach

The *Project Approach* curriculum was implemented in public pre-kindergarten classrooms in Wisconsin. In the control classrooms, teachers reported implementing their own teacher-developed, nonspecific curricula. No impacts on the pre-kindergarten student-level outcomes were found. A negative impact on behavior was found at the end of kindergarten. No impacts were found on the classroom-level outcomes.

Project Construct

Project Construct was implemented in full-day child care centers in Missouri. In the control schools, teacher-developed generic curricula were implemented. No impacts on the pre-kindergarten or kindergarten student-level outcomes were found. No impacts were found on the classroom-level outcomes.

Ready, Set, Leap!

Ready, Set, Leap! was implemented in pre-kindergarten programs in New Jersey. In the control condition, teachers used the *High/Scope* approach. No impacts on the pre-kindergarten and kindergarten student-level outcomes were found. No impacts were found on the classroom-level outcomes.