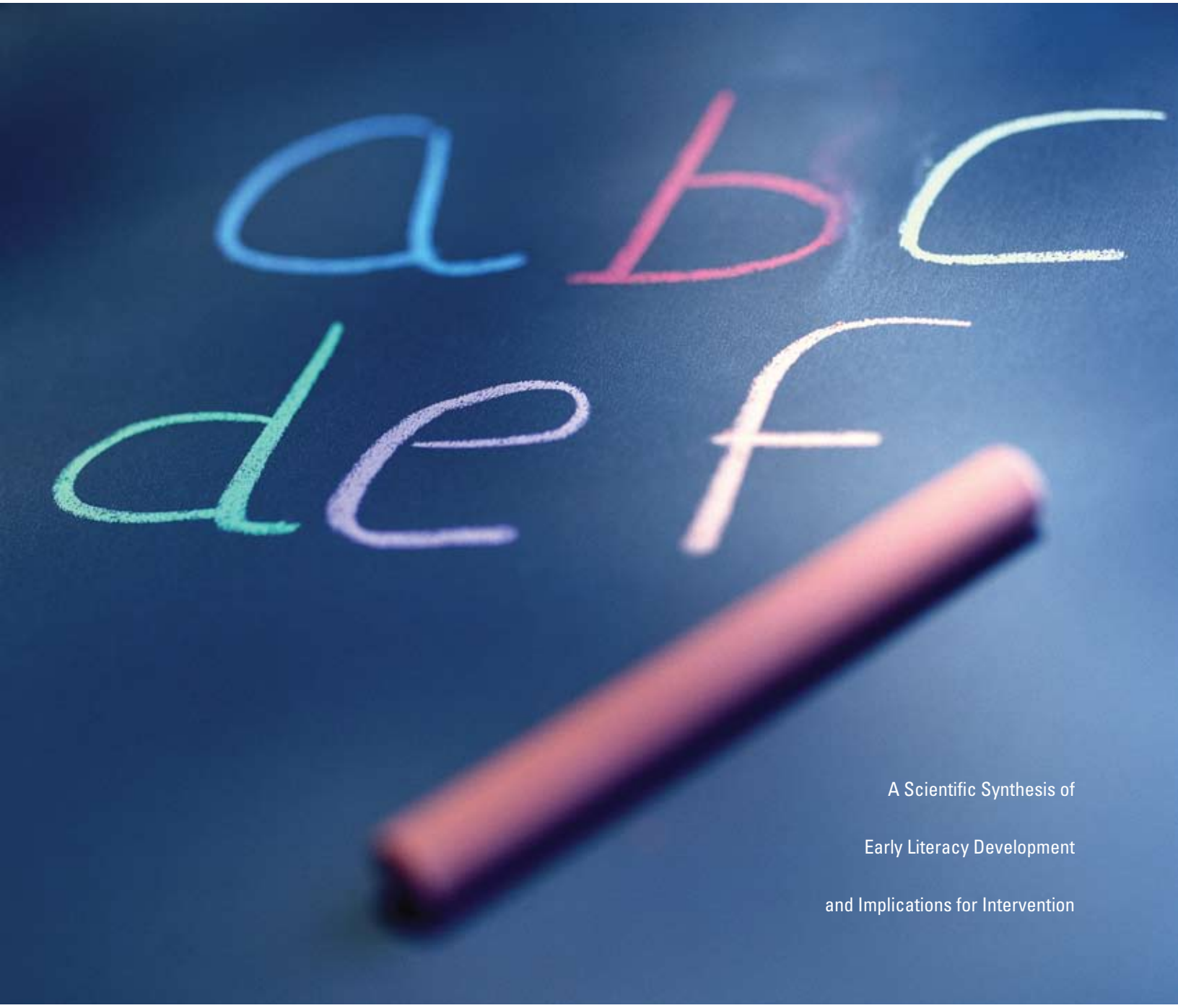
Developing Early Literacy

REPORT OF THE NATIONAL EARLY LITERACY PANEL



A Scientific Synthesis of

Early Literacy Development

and Implications for Intervention

National Institute for Literacy

National Center for Family Literacy

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2008

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The National Institute for Literacy, an agency in the Federal government, is authorized to help strengthen literacy across the lifespan. The Institute provides national leadership on literacy issues, including the improvement of reading instruction for children, youth, and adults by dissemination of information on scientifically based research and the application of those findings to instructional practice.
Sandra Baxter, Director
Lynn Reddy, Deputy Director

The Partnership for Reading, a project administered by the National Institute for Literacy, is a collaborative effort of the National Institute for Literacy, the National Institute of Child Health and Human Development, the U.S. Department of Education, and the U.S. Department of Health and Human Services to make scientifically based reading research available to educators, parents, policy makers, and others with an interest in helping all people learn to read well.

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Disclosure

Background

In 1999, the Head Start Bureau entered into a five-year cooperative agreement with the National Center for Family Literacy (NCFL) to administer the Head Start Family Literacy Project (HSFLP).

In 2001 The National Institute for Literacy (NIFL) entered into an Interagency Agreement with the Department of Health and Human Services (HHS) to support the cooperative agreement between the Head Start Bureau and the National Center for Family Literacy (NCFL). Under this agreement, NCFL was tasked with organizing and overseeing the National Early Literacy Panel (NELP).

Beginning in 2002, Timothy Shanahan of the University of Illinois at Chicago began serving as the panel chair of the NELP. In this role Professor Shanahan acted as a facilitator for the panel. Several months later, he also assumed a voluntary advisory board position with NCFL.

In 2006, he was appointed by President George W. Bush to serve on the Advisory Board of the National Institute for Literacy. By this date, the active work of the panel and panel chair in preparing for the writing of the final report was complete. As an advisory board member, Professor Shanahan abides by the rules of Federal Statute U.S.C. §208 (a), and played no role in the creation and funding of this project or supervision of project staff during his work on the NELP and in his role as an advisory board member.

Authorization

NIFL was authorized to engage in this agreement with HHS by section 2258 of the Reading Excellence Act (REA), Title II, Part C of the Elementary and Secondary Education Act of 1965, as amended, which requires NIFL to disseminate information on scientifically-based reading research.

P.L. 97-35 (the Head Start Statute) authorizes the underlying cooperative agreement between HHS and NCFL.

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Report

OF THE NATIONAL EARLY LITERACY PANEL

The National Early Literacy Panel

The National Early Literacy Panel (NELP) was convened in 2002 to conduct a synthesis of the scientific research on the development of early literacy skills in children ages zero to five. The National Institute for Literacy (NIFL) acted as the lead agency in this project, in consultation with cooperating agencies from the Partnership for Reading. The National Center for Family Literacy (NCFL), working closely with NIFL, coordinated NELP's work in the completion of the synthesis.

NELP was established for the express purpose of summarizing scientific evidence on early literacy development and on home and family influences on that development. The panel's primary purpose was to synthesize research to contribute to decisions in educational policy and practice that affect early literacy development and to determine how teachers and families could support young children's language and literacy development. In addition, this evidence would be a key factor in the creation of literacy-specific materials for parents and teachers and staff development for early childhood educators and family-literacy practitioners.

NCFL project staff generated a list of expert researchers in areas of reading, early literacy, language, cognition, English as a second language, pediatrics, special education, research methodology, and early childhood education. NIFL and its partner agencies approved the potential panelists before invitations were extended to the researchers seeking their participation as members of the panel. The members of NELP and their affiliations are as follows:

Timothy Shanahan (panel chair), Professor of Urban Education at the University of Illinois at Chicago (UIC) and Director of the UIC Center for Literacy.

Anne E. Cunningham, Associate Professor in the Graduate School of Education and Director of the Joint Doctoral Program in Special Education at the University of California, Berkeley.

Kathy Escamilla, Professor in the School of Education at the University of Colorado and affiliated with the BUENO Center for Multicultural Education at the University of Colorado.

Janet E. Fischel, Professor of Pediatrics and Psychology at the State University of New York at Stony Brook and Director of Pediatric Medical Evaluation, Director of the

Division of Developmental and Behavioral Pediatrics, Director of the Stony Brook Reading and Language Laboratory, and Associate Director of the Pediatric Residency Training Program.

Susan Landry, Michael Matthew Knight Professor in the Department of Pediatrics at the University of Texas Health Science Center at Houston, Chief of the Division of Developmental Pediatrics, and Director of the Children's Learning Institute (formerly, the Center for Improving the Readiness of Children for Learning and Education [CIRCLE]) in the Department of Pediatrics.

Christopher J. Lonigan, Professor in the Department of Psychology at Florida State University and Associate Director of the Florida Center for Reading Research.

Victoria J. Molfese, professor and Ashland/Nystrand Chair in Early Childhood Education, at the University of Louisville; and Director of the University's Early Childhood Research Center.

Chris Schatschneider, Professor of Psychology at Florida State University and Associate Director of the Florida Center for Reading Research.

Dorothy S. Strickland, Professor of Reading and Samuel DeWitt Proctor Professor of Education at Rutgers University.

NELP met on 12 occasions between April 2002 and February 2006. During these meetings, they deliberated on the proper way to search, synthesize, and summarize the research evidence on early literacy learning. Various subcommittees from the panel also met on several occasions and carried on these conversations through conference calls and email.

Although panelists made the analytical decisions and supervised the research efforts, NCFL staff carried out much of the NELP work. This work included organizing the panel, conducting electronic and hand searches, locating articles, and coding the information from the original studies so that analyses could be conducted. Most notable in this regard were the efforts of the following NCFL staff members:

Laura Westberg, Director of Special Projects and Research
Kelly Coots, Research Specialist
Lisa Smith Jackson, Research Specialist
Michelle Parkerson, Administrative Support Specialist
Akeel Zaheer, Vice President for Program Services
Tony Peyton, Senior Director, Federal Initiatives, Policy & Research
Sharon Darling, President and founder.

Executive Summary

OF THE REPORT OF THE NATIONAL EARLY LITERACY PANEL

Christopher J. Lonigan
Florida State University

Timothy Shanahan
University of Illinois at Chicago

The National Assessment of Educational Progress reveals that 37 percent of U.S. fourth graders fail to achieve basic levels of reading achievement. The incidence of reading failure is even higher within low-income families, ethnic minority groups, and English-language learners. Large-scale studies have shown that young children—those entering kindergarten and first grade—vary greatly in their attainment of the early precursor skills that provide the launching pad for later literacy learning (West, Denton, & Germino-Hausken, 2000; West, Denton, & Reaney, 2000). What can be done in U.S. homes, preschools, and kindergartens to better prepare children to succeed in learning to read and write?

In 1997, the U.S. Congress asked that a review of research be conducted to determine what could be done to improve reading and writing achievement. The resulting *Report of the National Reading Panel: Teaching Children to Read* (NICHD, 2000) has been influential in helping to guide reading-education policy and practice in the United States. However, that report did not examine the implications of instructional practices used with children from birth through age 5. To address this gap in the knowledge base, the National Early Literacy Panel (NELP) was convened. The panel was asked to apply a similar methodological review process to that used by the National Reading Panel (NRP) to issues of instructional practices for young children so that parents and teachers could better support their emerging literacy skills.

NELP was appointed in 2002 and carried out its work under the auspices of the National Center for Family Literacy (NCFL). Laura Westberg, director of special projects and research at NCFL directed the effort. The National Institute for Literacy (NIFL) funded the panel's work in consultation with the National Institute for Child Health and Human Development (NICHD), the U.S. Department of Education, and the Office of Head Start in the U.S. Department of Health and Human Services. The panel included the following experts in literacy and early childhood education:

Anne Cunningham, University of California, Berkeley
Kathy Escamilla, University of Colorado at Boulder
Janet Fischel, State University of New York at Stony Brook

Susan H. Landry, University of Texas–Houston
Christopher J. Lonigan, Florida State University
Victoria Molfese, University of Louisville
Chris Schatschneider, Florida State University
Timothy Shanahan, NELP chair, University of Illinois at Chicago
Dorothy Strickland, Rutgers University.

Questions Addressed by the National Early Literacy Panel

NELP's primary goal was to identify interventions, parenting activities, and instructional practices that promote the development of children's early literacy skills. Toward that end, the panel posed the following four questions:

1. What are the skills and abilities of young children (age birth through five years or kindergarten) that predict later reading, writing, or spelling outcomes?

2. Which programs, interventions, and other instructional approaches or procedures have contributed to or inhibited gains in children's skills and abilities that are linked to later outcomes in reading, writing, or spelling?

3. What environments and settings have contributed to or inhibited gains in children's skills and abilities that are linked to later outcomes in reading, writing, or spelling?

4. What child characteristics have contributed to or inhibited gains in children's skills and abilities that are linked to later outcomes in reading, writing, or spelling?

NELP adopted a methodology that allowed for the identification and selection of published studies relevant to the panel's questions, a coding system that allowed for the combination and comparison of studies, and an appropriate method of statistical analysis. Electronic searches were conducted using PsycINFO and the Education Resources Information Center (ERIC), and these were supplemented with hand searches of major research journals, reference checks of past literature reviews, and nominations from leading experts in the field of early literacy. These search procedures yielded more than 8,000 potential articles that were screened to determine their relevance to the research questions and their consistency with all selection criteria established by the panel. This led to the identification of approximately 500 research articles that were used in the meta-analyses conducted by the panel. The meta-analyses summarized both correlational data showing the relationships between children's early abilities and skills and later literacy development and experimental data that showed the impact of instructional interventions on children's learning.

Key Findings of the National Early Literacy Panel

Identification of the Domain of Early Literacy Skills

The panel set out first to establish which early skills or abilities could properly be said to be the precursors of later literacy achievement. This was important because, without such

a determination, it would be impossible to ascertain what programs or practices were most effective, because, even in the best of circumstances, most young children develop few conventional literacy skills before starting school. To identify the essential early skills or abilities relevant to later literacy development, the panel searched for published scientific studies that could provide correlational evidence showing the relationship between early skill attainment and later literacy growth in decoding, reading comprehension, or spelling.

Conventional literacy skills refers to such skills as decoding, oral reading fluency, reading comprehension, writing, and spelling. The use of these skills is evident within all literacy practices, and they are readily recognizable as being necessary or useful components of literacy. The term *conventional literacy skills* is not widely used in the field but is adopted here to distinguish between these aspects of literacy that are clearly the focus of the reading, writing, and spelling instruction provided to elementary and secondary students and those earlier-developing precursor skills that may not themselves be used within literacy practice but that may presage the development of conventional literacy skills. Conventional skills can be thought of as being more sophisticated, mature, or later-developing manifestations of reading and writing, and they are to be contrasted with *precursor*, *predictive*, *foundational*, or *emergent skills* (all terms used in this report). The report sometimes uses, more generally, *early literacy skills*, which can refer to both precursor skills and the conventional literacy skills of preschool and kindergarten children.

Conventional reading and writing skills that are developed in the years from birth to age 5 have a clear and consistently strong relationship with later conventional literacy skills. Additionally, six variables representing early literacy skills or precursor literacy skills had medium to large predictive relationships with later measures of literacy development. These six variables not only correlated with later literacy as shown by data drawn from multiple studies with large numbers of children but also maintained their predictive power even when the role of other variables, such as IQ or socioeconomic status (SES), were accounted for. These six variables include

- alphabet knowledge (AK): knowledge of the names and sounds associated with printed letters
- phonological awareness (PA): the ability to detect, manipulate, or analyze the auditory aspects of spoken language (including the ability to distinguish or segment words, syllables, or phonemes), independent of meaning
- rapid automatic naming (RAN) of letters or digits: the ability to rapidly name a sequence of random letters or digits
- RAN of objects or colors: the ability to rapidly name a sequence of repeating random sets of pictures of objects (e.g., “car,” “tree,” “house,” “man”) or colors
- writing or writing name: the ability to write letters in isolation on request or to write one’s own name
- phonological memory: the ability to remember spoken information for a short period of time.

An additional five early literacy skills were also moderately correlated with at least one measure of later literacy achievement but either did not maintain this predictive power when other important contextual variables were accounted for or have not yet been evaluated by researchers in this way. These additionally potentially important variables include

- concepts about print: knowledge of print conventions (e.g., left–right, front–back) and concepts (book cover, author, text)
- print knowledge: a combination of elements of AK, concepts about print, and early decoding
- reading readiness: usually a combination of AK, concepts of print, vocabulary, memory, and PA
- oral language: the ability to produce or comprehend spoken language, including vocabulary and grammar
- visual processing: the ability to match or discriminate visually presented symbols.

These 11 variables consistently predicted later literacy achievement for both preschoolers and kindergartners. Not surprisingly, these measures were usually more predictive of literacy achievement at the end of kindergarten or beginning of first grade than of later literacy growth. The report provides an analysis of the particular relations among these variables. For instance, oral language was found to play a bigger role in later literacy achievement when it was measured using more complex measures that included grammar, the ability to define words, and listening comprehension than when measured using only simple vocabulary knowledge. Also, children's early PA—that is, their ability to distinguish among sounds within auditory language—was found to be an important predictor of later literacy achievement, expanding on earlier NRP findings.

Instructional Practices That Enhance Early Literacy Skills

The panel also set out to identify studies that employed experimental or quasiexperimental methods to determine the effectiveness of instructional strategies, programs, or practices in imparting conventional literacy skills or any of these precursor skills to young children. The panel did not set out to find evaluations of previously identified programs or interventions but searched for all such studies that had been published in refereed journals in the English language. The panelists then grouped the identified studies into five analytical categories. The categories of intervention and the number of studies within each category included the following:

- Code-focused interventions (n = 78): Interventions designed to teach children skills related to cracking the alphabetic code. Most code-focused interventions included PA instruction.
- Shared-reading interventions (n = 19): Interventions involving reading books to children. These interventions included studies of simple shared reading and those that encouraged various forms of reader-child interactions around the material being read.

- Parent and home programs (n = 32): Interventions using parents as agents of intervention. These interventions may have involved teaching parents instructional techniques to use with their children at home to stimulate children's linguistic or cognitive development.
- Preschool and kindergarten programs (n = 33): Studies evaluating any aspect of a preschool or kindergarten program. Ten studies in this category concerned one particular intervention (the Abecedarian Project). Other studies evaluated effects of educational programs, curricula, or policies, such as extended-year experience, on kindergartners.
- Language-enhancement interventions (n = 28): Studies examining the effectiveness of an instructional effort aimed at improving young children's language development.

The code-focused instructional efforts reported statistically significant and moderate to large effects across a broad spectrum of early literacy outcomes. Code-focused interventions consistently demonstrated positive effects directly on children's conventional literacy skills. Book-sharing interventions produced statistically significant and moderate-sized effects on children's print knowledge and oral language skills, and the home and parent programs yielded statistically significant and moderate to large effects on children's oral language skills and general cognitive abilities. Studies of preschool and kindergarten programs produced significant and moderate to large effects on spelling and reading readiness. Finally, language-enhancement interventions were successful at increasing children's oral language skills to a large and statistically significant degree. Together, these findings suggest that there are many things that parents and preschools can do to improve the literacy development of their young children and that different approaches influence the development of a different pattern of essential skills.

There is great interest in the idea of providing age-appropriate interventions. However, there were few important differences among these categories of study with regard to age; one important exception was in the area of language interventions, which showed greater effectiveness early on. Otherwise, when age-level comparisons were possible, the large and significant effects of the various interventions were obtained with groups of both younger and older children. This means that most of the types of instruction that are effective in kindergarten are very similar to those that can be used in preschool. Unfortunately, there have not been direct tests of age differentiation in early literacy instruction across kindergarten and preschool, and there are still too few studies of preschool literacy instruction to provide comparison results that can be embraced with a high degree of certainty. Future research into this issue could shed greater light on what, to some observers, may seem a surprising finding.

Few interventions improved conventional literacy skills or the precursor skills most related to later literacy growth, the exception being code-focused interventions. One reason so few interventions were found to foster improvement in these measures is that few intervention studies with young children included measures of such outcomes. Generally, code-focused intervention studies included such measures, while studies of other instructional approaches did not. It is possible that some of these other approaches may also be effective in improving early literacy skills, but that can only be determined through studies employing such measures. Code-focused programs, book sharing, programs for parents to use at home, and language-enhancement instruction all improved children's oral language skills.

The panel wanted to determine whether any child characteristics influenced the effectiveness of the instructional interventions. In most cases, the panel could not determine the role of children's characteristics because of reporting limitations in the original studies. In general, however, variables, such as age, SES, and race, did not seem to alter the effectiveness of the various interventions, and it will take future research to determine whether certain interventions would be effective with particular groups of children.

It should be noted that the interventions that produced large and positive effects on children's code-related skills and conventional literacy skills were usually conducted as one-on-one or small-group instructional activities. These activities tended to be teacher-directed and focused on helping children learn skills by engaging in the use of those skills. Almost all of the code-focused interventions included some form of PA intervention. These PA activities generally required children to detect or manipulate (e.g., delete or blend) small units of sounds in words. Few of the interventions used rhyming activities as the primary teaching approach. Teaching children about the alphabet (e.g., letter names or letter sounds) or simple phonics tasks (e.g., blending letter sounds to make words) seemed to enhance the effects of PA training.

Limitations

The major limitation confronting any meta-analysis is the quality of the original studies that are being combined. All studies have varying degrees of weakness in their implementation and reporting. A basic premise of meta-analysis is that all studies on a particular issue would be unlikely to suffer the same problems and that the influence that such factors may have on results can therefore be analyzed and understood. The reality is that the various study-design features, demographic characteristics of participating children, and crucial elements of the educational environments are hopelessly confounded across studies. Therefore, meta-analysis provides clues to what might be influencing the effectiveness of an intervention but cannot provide the final word on such findings.

It is impossible to be certain that any meta-analysis will identify all studies on a particular topic, and any study that is not included could provide information that would be at odds with the conclusions drawn. In this case, because the meta-analysis examined only the results of published studies, it is possible that a somewhat different picture could be derived if a broader net were cast.

In this case, many substantive issues of great concern to educators and parents could not even be explored adequately because of limitations in the reporting of original studies. There are many theories, both naïve and scientific, suggesting the likelihood of individual differences in instructional effectiveness that demographic characteristics might mitigate. This meta-analysis evaluated whether such variables as race or SES mitigated or moderated the effectiveness of the various interventions. Unfortunately, it was all too rare that the original studies had provided sufficient data to allow for unambiguous conclusions to be drawn.

Future Research Directions

The NELP report provides a rich set of findings about the relationship between early developing child skills and later literacy attainment and the effectiveness of interventions for helping young

children to progress toward successful literacy learning. The analyses carried out by the panel also reveal important gaps in the empirical research record that future research should address.

The panel identified which early measures of children's skills were predictive of later decoding, reading comprehension, and spelling achievement. Some of these variables—certain aspects of phonological processing, for example—have been shown in previous research to be causally connected to literacy achievement (i.e., if those skills are taught, children attain higher levels of literacy), but this is not true for all of these variables. Future research must determine whether enhanced early instruction aimed at improving skills, such as AK, concepts of print, or oral language development, would consistently lead to higher later attainments in literacy.

The panel identified a wide variety of interventions that improved children's early literacy skills, and one pattern that emerged was that the various categories of interventions had qualitatively different outcomes. For example, the code-oriented interventions improved children's knowledge of phonology and print conventions, whereas shared-book interventions enhanced children's language development. It is possible that some of these interventions would actually have a wider impact than what was determined here, but that will require that future studies of such interventions employ a wider range of outcome measures. In fact, this would be a useful research convention for early literacy-intervention research; if such studies would use a wider range of outcome measures, it would be possible to determine the breadth of impact that these interventions may have. Also, given the complementary findings for the various types of intervention, it would be helpful if researchers would undertake longitudinal studies of more complex interventions (such as combinations of the types of efforts that have worked in the past), making it possible to evaluate the long-term value of more ambitious and complete efforts to develop early literacy skills.

Finally, the NELP report found few demographic differences in children's learning patterns, and even those that were found were confounded. Future studies of early literacy skills should consider the possibly varied impact of early interventions, particularly on large and growing groups of children who struggle with literacy (such as second-language learners and children being raised in poverty). However, even if research studies are not designed to specifically answer such questions, it would be helpful if they would report their data separately for children from different demographic categories, as this would make it possible for future meta-analyses to make sense of any patterns that may exist.

Conclusions

The NELP report represents a systematic and extensive synthesis of the published research literature concerning children's early literacy skills. It provides educators and policymakers with important information about the early skills that are implicated in later literacy learning, as well as information about the type of instruction that can enhance these skills. The results also identify areas in which additional research is needed.

The meta-analyses conducted by the panel showed that a wide range of interventions had a positive impact on children's early literacy learning. However, these positive results were due

to the nature and intensity of the instructional activities examined in the studies. There is now a clear need for translational research. Researchers or their agents delivered many of the interventions; examinations of more typical implementations of such programs within early childhood education are needed. Many of the high-impact instructional strategies involved activities and procedures different from those typically seen in early childhood classrooms. These interventions were usually delivered as one-on-one or small-group activities, they occurred frequently, and they were adult-directed. Few interpretable studies evaluated the effects of merely providing a literacy-rich or language-rich classroom environment.

Finally, there were significant problems with the quality of much of the research in this area. Many studies used simple pretest-posttest designs, which provide no causally interpretable evidence, and studies often did not provide evidence that these groups were equivalent prior to an intervention or represented the same population. Often, there was evidence for group differences that existed before the start of the intervention. The panel was unable to rely on the data drawn from such badly designed studies, and they were excluded from all of the analyses reported here. These flaws do not allow appropriate postintervention differences to be attributed unambiguously to the intervention; neither do studies in which the intervention is confounded with other important factors that could be the source of any observed effects. Ultimately, building a larger and more comprehensive knowledge base concerning early literacy skill development and promotion will require more high-quality research.

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Introduction

TO THE REPORT OF THE NATIONAL EARLY LITERACY PANEL

Timothy Shanahan
University of Illinois at Chicago

Introduction

The ability to read and write is fundamental to full participation in American society. Our nation of farmers and mechanics has been transformed into one in which economic, civic, and social success depend on educational attainment for all, particularly in literacy. The rapid influx of technology into our daily lives and the internationalization of the economic marketplace have raised the demand for a literate citizenry to the highest levels ever (Carnevale, 1991).

Many Americans cannot read well enough to take full advantage of the benefits of society—or to contribute fully to its sustenance (Kirsch, Jungeblut, Jenkins, & Kolstad, 1993). Those who are low in literacy are paid less, are more often out of work, are less likely to vote, are less informed about civic affairs, are less able to meet the health-care needs of their families, and are more likely to have trouble with the law or to become ensnared in other socially harmful activities.[1] Literacy is implicated in virtually every sphere of our daily lives, no matter how mundane or profound—from following a prescription to taking part in a religious service, from sending an email to buying something over the Internet, from reading a sign for directions to reading a book to one's children.

In 1997, the U.S. Congress requested the appointment of a panel of scientists to review research on reading instruction to determine what could be done to improve reading achievement. The National Reading Panel (NRP) conducted a review of research on elementary and secondary reading instruction (NICHD, 2000), and its report has become the basis of new federal education laws designed to foster improved reading instruction from kindergarten to third grade.

As critics have pointed out, NRP failed to examine what could be done during the preschool years to better prepare children for success in reading.[2] This new report seeks to redress that important omission. This report, written by the National Early Literacy Panel (NELP),

[1] The statistics on employment, economic well being, voting, and health are drawn from Venezky, Kaestle, and Sum (1987). That report was based on data drawn from Kirsch and Jungeblut (1986). These findings were further confirmed by later analyses of the National Adult Literacy Survey, including Kirsch, Jungeblut, Jenkins, and Kolstad (1993) and Sum (1999). Statistics on the relationship of literacy to crime and incarceration are from Haigler, Harlow, O'Connor, and Campbell (1994), and the statistics on the relationship of literacy attainment to other social problems, including teen pregnancy, drug use, and violence are from Matson and Haglund (2000), Bennett, Brown, Boyle, Racine, and Offord (2003), and Kellam and Anthony (1998).

[2] As summarized in Shanahan (2004).

systematically examines the research on early literacy instruction to determine what best can be done to prepare young children for literate lives.

Why Focus on Young Children

More than one-third of America's fourth graders read at levels so low they cannot complete their schoolwork successfully (Lee, Grigg, & Donahue, 2007). Reading achievement is particularly low for Latino and African American fourth graders, 56 percent and 60 percent, respectively, of whom read at those below-basic levels that do not even provide sufficient support to allow the completion of schoolwork (Lee, Grigg, & Donahue, 2007). National literacy assessments reveal that levels of literacy attainment are not much better for eighth or 12th graders or even adults,[3] which is not surprising, given that beginning literacy is highly predictive of later literacy attainment.

Several research studies have demonstrated that early cognitive and linguistic development predict later achievement—even much later. Various measures administered at the preschool and kindergarten levels reveal that patterns of preschool learning are closely linked with reading achievement in the primary grades (Scarborough, 1998). Young children who demonstrate oral language proficiency and early abilities in processing print do better in learning to read in first, second, and third grades (Scarborough, 2001). This means that learning achieved during these early years is likely to be sustained throughout the primary-school years and is an important basis for successful early performance in school.

Success in literacy learning during the primary grades is even more indicative of later literacy achievement. Seventy-four percent of children who perform poorly in reading in third grade continue to do so into high school, further underlining the importance of preparing children to enter school ready to learn (Fletcher & Lyon, 1998).

Before children enter elementary school, they must develop many linguistic and cognitive skills that will make later academic learning possible. By the age of five, however, children differ markedly in their success in reaching these developmental goals (Entwisle & Alexander, 1993), and these early differences reverberate throughout a child's schooling, limiting or amplifying learning success.

Differences in early achievement have been correlated with mothers' levels of education and family economic success (Nord, Lennon, Liu & Chandler, 2000). Not all children enter school equally prepared to learn to read, and those from the nation's most economically disadvantaged families are the least likely to be well prepared to succeed—opening initial achievement gaps between rich and poor and black and white that are never spanned during a child's schooling. A growing body of evidence shows that high-quality early education can have long-lasting benefits (Bowman, Donovan, & Burns, 2001; Shonkoff & Phillips, 2000), but these studies have not usually focused on early literacy learning outcomes.

The 2000 U.S. census indicates that there are approximately 21 million children ages birth to 5 residing in the United States (U.S. Census Bureau, 2002). Of these, approximately 5.5 million

[3] Statistics on eighth-grade reading levels are drawn from NAEP and NCES (2007); 12th-grade reading statistics are from Campbell, Hombo, and Mazzeo (2000); and adult-literacy statistics were drawn from Kirsch, Jungeblut, Jenkins, and Kolstad (1993).

are enrolled in some form of center-based preschool, including approximately 55 percent of four-year-olds (NCES, 2000). Almost a million of these children are enrolled in federally supported Head Start programs at an annual cost of $6 billion (HHS, 2008). This means that there are large numbers of young children—including young children from low-income families, already enrolled in preschool programs and child-care arrangements—who could benefit from enhanced preschool literacy preparation.

Most children spend considerable time with their parents rather than in preschools or child-care arrangements (U.S. Census Bureau, 2002). Because parents, too, can provide children with excellent literacy preparation during these early years, information on what would benefit young children's literacy development would be useful in those situations as well.

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Chapter 1

METHODOLOGY OF THE NATIONAL EARLY LITERACY PANEL

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Overview

The National Early Literacy Panel (NELP) was charged with conducting a research synthesis on early literacy development. This charge was not simply to complete a literature review but to engage in a systematic empirical study in which data are collected, analyzed, and evaluated in an objective and systematic way to determine answers to specified research questions. In that sense, a research synthesis is an independent research study in its own right that uses existing studies as the data for its analysis. As independent research studies, research syntheses include selection criteria for identification of relevant research, standards for judging the quality of research, operational definitions, and replicability of methods.

Meta-analysis is increasingly being used to summarize research evidence for a variety of purposes, and meta-analytic procedures continue to develop. There are still controversies about how best to conduct and interpret sound meta-analytic work. NELP used methodology consistent with that used by the National Reading Panel (NRP) in the completion of its synthesis on reading and its implications for reading instruction. NELP consulted other key resources on research synthesis in order to improve on the original model and to better meet the specific inquiry demands of the research questions (Cooper & Hedges, 1994; Cooper, 1998; Shanahan, 2000). Generally, the procedures used by NELP sought to identify the most comprehensive set of obtainable data in an unbiased way and to analyze those data in a straightforward manner with a minimum of manipulation or recalculation of the original data. Although various innovative methods have been proposed for "correcting" original data (Hunter & Schmidt, 2004), it is not clear whether such procedures actually improve the validity of results, so they were not employed here.

Simply put, meta-analysis is a procedure aimed at determining the average results of a collection of independent studies and of examining variations in those results to determine the reason for

those variations. This means that researchers must identify a population of studies that address a particular question, develop rules for systematically selecting which studies can be combined or compared, code key comparative information from the original studies, and analyze these results statistically to determine the size of an effect and which variations in study procedures, subject samples, or instructional circumstances are correlated with differences in these effects.

This chapter provides a description of the research questions that NELP attempted to answer. It also describes the methods used to identify and select research studies, to code those studies, and to analyze the results.

Research Questions

To achieve the purposes of the project in synthesizing the research literature on early literacy development, NELP formulated four basic research questions:

1. What are the skills and abilities of young children (ages birth through five years or kindergarten) that predict later reading, writing, or spelling outcomes?

2. Which programs, interventions, and other instructional approaches or procedures have contributed to or inhibited gains in children's skills and abilities that are linked to later outcomes in reading, writing, or spelling?

3. What environments and settings have contributed to or inhibited gains in children's skills and abilities that are linked to later outcomes in reading, writing, or spelling?

4. What child characteristics have contributed to or inhibited gains in children's skills and abilities that are linked to later outcomes in reading, writing, or spelling?

The panel decided that, to answer research questions 2, 3, and 4, research question 1 had to be adequately answered first. That is, to examine adequately the impact of environments, child characteristics, and interventions on early literacy skills and abilities, it was necessary to first determine what constitutes the early skills or precursors of reading, writing, or spelling. To do this, the panel had to determine what early abilities and skills were predictive of later outcomes in reading, writing, or spelling that would be appropriate to consider in answering these other questions.

The first question will be answered in detail in Chapter Two of this report. Chapters Three through Seven will then address questions 2, 3, and 4 for a particular major type of intervention. Chapter Three will consider code-focused interventions (those that explicitly teach phonological awareness [PA], phonics, alphabet, or print awareness). Chapter Four covers shared-reading interventions, Chapter Five focuses on parent and home programs, Chapter Six analyzes the effectiveness of preschool and kindergarten programs, and Chapter Seven considers language-enhancement interventions. For instance, Chapter Three considers whether code-focused efforts are effective in improving children's literacy and literacy-related skills (question 2), then considers whether such programs are more or less effective under various instructional circumstances (question 3) and whether they work better with some types of children (question 4). All of the intervention chapters have that structure.

Methodology for Predictors

Search Terms and Search Procedures

Prior to conducting a systematic electronic search, project staff generated a list of search terms in nine categories (language, cognition, motivation, schooling, home and family, word learning, fluency, reading comprehension, miscellaneous) that NELP reviewed, revised, and approved. To identify key terms, staff consulted such references as *The Literacy Dictionary* (Harris & Hodges, 1995), *Preventing Reading Difficulties in Young Children* (Snow, Burns, & Griffin, 1998), *Handbook of Early Literacy Research* (Neuman & Dickinson, 2001), and *Handbook of Reading Research* (Pearson, Barr, & Kamil, 2000, pp. 209–226). After NELP's review and revision of the terms and categories, a final list was completed with 284 key search terms identified across the nine categories. In addition to the nine categories, two categories were created for age group and literacy outcomes with a total of 67 key terms identified in these categories. (See Appendix 1.A for a complete list of the superordinate categories and subordinate search terms.)

Searches were conducted using both the Education Resources Information Center (ERIC) and PsycINFO databases. Each subordinate term within a category was linked using *or* statements to identify as many citations as possible of unique research articles that referred to that category. Then the category citations were linked with age identifiers and literacy outcomes to ensure the relevance of this information to the research questions. The goal was to generate as many records in each database for each of the nine topical categories. This search process resulted in 7,313 records. Table 1.1 identifies the number of records generated for each superordinate term per search engine.

Table 1.1. Records Generated per Search Engine

Superordinate Term	ERIC	PsycINFO Total	PsycINFO, 1984–Present	PsycINFO, 1967–1983	PsycINFO, 1887–1966
Language	963	427	340	75	12
Cognition	518	360	259	93	18
Motivation	258	97	75	16	6
Schooling	1,363	421	306	98	17
Home and family	528	213	176	32	5
Word learning	384	198	163	32	3
Fluency	242	64	52	11	1
Reading comprehension	191	103	80	21	2
Miscellaneous	796	187	135	44	8

Inclusion and Exclusion Criteria

To ensure the identification of studies of high quality and relevance to the research questions, NELP formulated initial screening criteria and rationales that included the following:

1. The study must be published in English, because the panel did not have the resources to review articles in other languages.

2. The study must be published in a refereed journal. This ensures a minimum level of quality, in that such research had previously been evaluated by a panel of experts and was judged to be of sufficient methodological rigor to warrant publication. The reliance on published studies alone increases the chances that results will be overly affected by publication bias. What this means is that studies that have positive results are more likely to be published, and therefore, the average effects that result from an analysis of published studies will tend to be higher. Although this is true, there are not well-validated procedures for searching for unpublished studies in unbiased ways, and the expense—in terms of both time and money—were beyond the means of this project. Given both the potential for limitations and the difficulties and uncertainties in overcoming them, the research team decided to follow the precedent of the NRP procedures and the definitions of scientific-based reading research expressed in federal education law, by relying solely on published studies that had received some level of independent quality screening. It is assumed that the effect sizes (ESs) obtained here would probably be somewhat attenuated if unpublished studies could be obtained.

3. The study must include empirical research that provided quantitative data on groups of children who represented the normal range of abilities and disabilities that would be common to regular classrooms (as opposed to special educational placements). The panel could examine only that research that analyzed data on children's early literacy learning. To be included, these studies had to provide quantitative data describing children within a normal range of abilities and disabilities so that the statistical data could be combined across the studies and to ensure the generalizability of results to the largest proportion of young children. Studies were excluded if they were purely descriptive; were case studies; reported only demographic information; were qualitative studies; or included children with neurological or degenerative disorders, such as acquired immune deficiency syndrome (AIDS) or autism, or children who were blind or deaf. The reason for these exclusions was to ensure the generalizability of combinable data that would be appropriate to the research questions.

4. Languages studied had to include English and other alphabetic languages (i.e., languages in which the orthography or written symbol system represents speech sounds). This criterion ensured that the research findings would be maximally relevant and valid to English learning because English uses an alphabetic writing system.

5. The study must include children between the ages of 0 and 5 or in kindergarten. Studies were included that targeted these ages alone, that included data on children from this age group that could be analyzed separately, or that included data on children from this age group that had been aggregated with the data of older children if the original research had shown that both groups performed the same.

To ensure both comprehensiveness and representativeness of the research, additional searching was undertaken to identify studies that met those criteria but that may not have been identified in the electronic searches. This was accomplished by consulting nine previously published research reviews or meta-analyses to locate any papers cited in those reviews that were missed in these searches. Additionally, the panel searched the reference lists of all articles identified electronically that it had accepted, panelists nominated articles of which they were aware, and

panelists nominated a selected set of eight research journals, on the basis of relevance and quality, all issues of which (2001–2003) were hand searched for additional relevant articles (number of articles identified in each of these journals is noted in parentheses):

The British Journal of Educational Psychology (no articles)
Child Development (two articles)
Developmental Psychology (no articles)
Early Childhood Research Quarterly (no articles)
Journal of Educational Psychology (three articles)
Journal of Learning Disabilities (no articles)
Reading Research Quarterly (one article)
Scientific Studies of Reading (one article).

Abstract and Article Review

Project staff screened the 7,313 records, which included abstracts, using these selection criteria and categorized them according to their relevance to the four research questions. *Ulrich's International Periodicals Directory* was consulted to identify whether the journals were refereed. If staff were unable to determine whether a journal was refereed through this source, each journal editor was contacted and queried about that journal's article-selection process.

The results of this initial screening of citations produced a set of 1,824 studies from which panel members, in pairs, reviewed article abstracts to ascertain the study's relevance to question 1. To be relevant to this research question, a study had to focus on a child skill or ability measured any time from birth through the beginning of kindergarten, and this skill or ability had to be statistically linked to a reading, writing, or spelling outcome measured from the conclusion of kindergarten to any time later, usually through a correlational procedure. If either of the two panelists determined that an article, as described in the title and abstract, was potentially relevant to the research question, it was added to the list of articles to be retrieved. On the basis of the abstract review, 685 full-text articles were retrieved for a second round of panel screening to determine whether the articles met the initial selection criteria and were relevant to question 1. Again, pairs of panelists reviewed articles independently. When the panelists' ratings were in disagreement concerning an article's status, they were contacted and asked to review their decisions and come to agreement about its inclusion. Occasionally, the two panelists would request a third panelist's opinion about the disposition of a particular article. At any stage of the process, if an article was excluded, the reason for the rejection was documented.

This process resulted in a final set of 275 studies identified for research question 1. Of these 275 articles, 41 were rejected during the coding process for a variety of reasons (usually the data were reported inadequately and did not allow for coding of the needed information from the study), resulting in a final set of 234 articles for analysis.

Coding Scheme and Coding Studies

NELP identified seven categories for classifying study characteristics: report identification (ID number, citation, study coder, whether study rejected and reason); setting (program type, ages or grades, country of sample, population density); demographics (information about

subjects, languages, maternal education, family structure); research design (experimental, quasiexperimental, correlational); experimental design features (subject assignment, components of treatment, treatment fidelity); nonexperimental design features (correlational information, sample selection, measurement issues); and measurement information—all research designs (test names and categories, reliability, measures, means and standard deviations, ES).

A coding instrument was developed using this coding scheme. A first reliability check on the coding instrument resulted in too many problems across coders to complete. To ensure consistency across coders, a coding manual was created with definitions of terms and operational definitions for coding procedures. Several panelists also made suggestions for revising the coding instrument. Using the revised coding instrument, a second coding trial was conducted with project coders. Results of an intercoder reliability check resulted in an agreement rate of 0.80. Instances of disagreement across coders were discussed and resolved. The coding manual was revised to reflect these coding problems. A final coding check involved a random selection of 10 percent of the already-coded articles that were then sent to panel members for an accuracy check. About half of these articles were returned with comments, suggestions, or feedback. As the coding of articles continued, when coders were confronted with especially difficult-to-code articles, panelists were consulted to provide coding assistance.

The panel decided to aggregate various measures used in the original studies into more general conceptual categories for the purposes of coding. For example, many articles were coded that measured aspects of reading that occurred in kindergarten or later. These measures were grouped into the larger constructs of (1) reading, including measures of individual word identification, decoding of nonsense words, and any other measure that tapped the accuracy of reading words; (2) reading comprehension, measures of students' understanding of a written passage; and (3) reading fluency, which was represented by assessments that measure a student's ability to accurately and quickly read a series of words or sentences. Many constructs were defined in this manner. (See Appendix 1.B for the complete coding instrument.) Once studies were coded and ESs were compared, the panel classified outcome measures based on descriptions of variables, content of published measures, or a combination of those. A summary of the outcome domains into which variables were classified, including their definitions, is included in Appendix 1.C.

Missing Data

As articles were coded, it became apparent that there were numerous instances of missing data, especially data that were critical to conducting a meta-analysis. In these instances, project staff attempted to contact article authors to retrieve the missing data. These attempts usually were not successful, as authors did not respond or no longer had the needed data. As a result, articles with missing data were excluded if the data that were missing were essential to carrying out the analyses.

Data Entry and Cleaning

After all the studies were identified and coded onto code sheets, they were entered into a database designed by the National Center for Family Literacy (NCFL). Two coders were in charge of

entering the data, and these coders double-entered approximately 10 percent of the information from the code sheets to allow an examination of the accuracy of the coding; the agreement was found to be above 0.95. Additionally, after the data were entered, two panelists reviewed approximately 20 percent of the original articles to ensure the accuracy of the data. Finally, any ES that was found to be an outlier (correlations below –0.30 or Cohen's *d* values greater than 3.0 or less than –3.0) was investigated for accuracy.

Unit of Analysis

Because many of the statistical procedures employed in a meta-analysis are sensitive to violations of the assumption of independence of observation, NELP decided to define the unit of analysis as the ESs obtained from independent groups. Frequently, a single article represented one group. However, in some cases, a particular group of participants was used in more than one study (longitudinal studies with multiple assessments across time were the bulk of these studies). When this occurred, results were grouped from across these articles and treated as a single group. Additionally, some articles reported data from multiple independent groups. If the groups were defined as distinct from one another, they were treated as independent groups.

Analysis

Studies for research question 1 consisted primarily of correlational data. These studies often reported correlations of measures that the panelists considered to be measuring the same relationship (i.e., multiple measures of PA correlated with multiple measures of reading). When this occurred, the panel averaged the Fisher z-transformed correlations so that each study contributed only one ES per relationship. The formula used for converting the correlations into z-scores is

$$Z_i = 0.5\left(\ln\left(\frac{1+r_i}{1-r_i}\right)\right),$$

where

Z_i = z-score that corresponds to the correlation from study i and

r_i = correlation from study i.

ESs obtained from each study were aggregated across studies by weighting the individual investigations by the inverse of the conditional variance of each z-transformed correlation:

$$v_i = \frac{1}{n-3},$$

where

v_i = variance of z-transformed correlation from study i and

n_i = number of subjects in study i.

And the weight (w_i) as

$$w_i = \frac{1}{v_i},$$

where

v_i = variance estimate for effect size from study i.

Weighted average ESs were computed based on a fixed-effect model estimation procedure that weighted each ES by the inverse of the estimated variance (w_i). These weighted mean Fisher z-correlations were then computed for each predictor-outcome relationship. The standard error (SE) of this estimate was computed by taking the square root of the inverse of the sum of the individual variance estimates that comprised that effect and was used to estimate 95 percent confidence intervals (CIs) for each Fisher z-transformed correlation. Finally, the estimate and the lower and upper bounds of the CI were converted back into Pearson correlations. Additionally, an estimate of the homogeneity of the combined ESs (Q) was estimated using the following formula:

$$Q = \sum_{i=1}^{k}\left(w_i Z_i^2\right) - \frac{\left(\sum_{i=1}^{k} w_i Z_i\right)^2}{\sum w_i},$$

where

k = number of studies contributing an effect,

w_i = weight of individual study i, and

Z_i = z-transformed correlation from study i.

Finally, the panel determined that, to report an ES, a minimum of three studies must have contributed to the estimation of that effect.

In addition to the meta-analyses of simple correlations, the panel examined multivariate studies that were retrieved as part of the search for the first research question. Multivariate studies typically use multiple regression or similar analytic techniques to examine a variable's predictive utility in the context of other variables. These multivariate studies were coded for each of the primary predictor variables identified by the meta-analyses of simple correlations. Coding included a list of all additional variables included as predictors in the multivariate analyses and whether the primary predictor variable continued to account for unique variance in the decoding, reading comprehension, or spelling outcome measure.

Methodology for Interventions

Research question 2 asked about the effectiveness of instructional procedures, interventions, or other intentional actions that adults could take to improve the literacy development of young children (similar to the types of research questions that NRP raised).

Search Terms and Search Procedures

The analyses for the first research question resulted in the identification of 13 measurable outcomes for early literacy instruction and intervention. Based on the findings from research question 1, project staff generated additional search terms using the 13 early literacy predictors (alphabet knowledge [AK], language, concepts about print, environmental print, invented spelling, listening comprehension, name writing, PA, phonological short-term memory (STM), rapid automatic naming (RAN), verbal IQ, visual memory, visual perception) as superordinate (category) terms. Following search procedures similar to those used for research question 1, searches were conducted in both ERIC and PsycINFO databases. This search resulted in 974 records. (See Appendix 1.C for a complete list of search terms.) Table 1.2 shows the number of records generated by each superordinate term per search engine.

Table 1.2. Records Generated per Search Engine for Predictor Variables

Predictor Superordinate Term	ERIC	PsycINFO
AK	4	14
Language	329	403
Concepts about print	2	3
Environmental print	1	1
Invented spelling	2	8
Listening comprehension	8	11
Name writing	4	10
PA	37	54
Phonological STM	1	1
RAN	0	1
Verbal IQ	5	16
Visual memory	0	6
Visual perception	10	43

Abstract and Article Review

Prior to conducting the search for interventions using the predictor variables as superordinate terms, panelists returned to the list resulting from the first screen of the original search. Rather than just looking for studies that linked a child skill or ability to reading outcomes through a correlational procedure, as was done for the first research question, it was necessary to review the abstracts to locate all studies of *interventions* that evaluated the impact of those interventions on reading, writing, or spelling measures or measures of any of the 13 predictor variables. Following the same procedures for abstract and article review for the first research question, this review resulted in the retrieval of 651 articles. Panel review of abstracts from the 974 records generated in the predictor search resulted in the retrieval of 280 articles. Combining the results of the previous search and the predictor search identified a total of 931 articles for retrieval and additional panel review.

Following the same procedures as for review of articles for the first research question, the panel accepted a total of 136 articles for this second research question. In their review of articles for

this question, panelists used the following additional inclusion and exclusion criteria for the reasons given:

1. The study must have employed an experimental or quasiexperimental design (QED). This criterion meant that an instructional procedure's effectiveness or ability to cause an improvement in an early literacy skill was evaluated in the study. In QEDs, evidence must be presented to show that preexisting groups were equivalent before manipulation on variables thought to be related to the outcome. This would most generally take the form of an appropriate pretest. Experiments ensure the equivalence of initial performance by randomly assigning subjects to conditions. Quasiexperiments, because they evaluate instructional procedures' effectiveness on the performance of intact groups, must use these measurement approaches to make sure that there are not existing differences among groups that could be misinterpreted as having resulted from the intervention.

2. If the independent variable in the study was completely confounded by another grouping variable, it was rejected. For instance, if there are two classrooms and one is assigned to receive an intervention and the other to do business as usual, classroom is completely confounded with intervention; hence, any obtained effects may be due to the intervention or to something about the specific classroom or classroom teacher, and there is no way to disentangle these causal effects. This criterion ensures that outcomes attributed to an intervention were actually caused by that intervention and not some other confounding variable.

3. One-group pretest-posttest–only designs were excluded. The most likely explanation of changes in skills from pre- to posttest in children is maturation. This criterion prevents the misattribution of changes that are due to maturation to an instructional procedure or effort.

4. Studies that did not contain sufficient information to derive an ES were rejected. The results of these studies could not be statistically combined with the results of the other studies, so they were set aside. Again, no efforts were made to impute missing information, as explained earlier.

5. Studies that did not have appropriate outcome measures were rejected. To determine whether an intervention had a positive impact on literacy learning, it was essential that the studies include appropriate outcome measures on which to evaluate the intervention's effectiveness. Studies that used conventional measures of literacy (such as measures of decoding, reading comprehension, oral reading fluency, writing quality, spelling) could be included, as could studies that used any of the categories of measures identified in Chapter Three (e.g., oral language development, AK, cognitive ability). Although there were not searches for interventions aimed at improving children's performance on readiness tests (tests that some schools use to predict later success in reading), if such measures were among those used in a study, their results are reported. Studies of children prior to or during kindergarten quite appropriately tend not to include such outcome measures. Accordingly, the panel set out to empirically determine which early skills were the strongest predictors of later literacy achievement (see Chapter Two). Studies that used outcome measures that evaluated

any of the important precursor skills identified in Chapter Two were also included in this analysis. (Chapters Three through Seven are organized by type of intervention rather than by particular outcome measure. This is consistent with NRP work and is more in accord with the types of decisions that must be made by those responsible for educational curricula.)

6. Studies were excluded that were considered short-term trials of fewer than three weeks; focused on a particular stimuli or portion of a learning task; had relatively few subjects; and measures used were usually those limited to the study's learning task, e.g., training children on letters and then measuring their learning of the specific letters reflected in the training materials. These kinds of studies can provide important clues to how learners process information or how instructional interventions might be formulated or improved. They do not provide a clear indication of the learning benefits of substantial or long-term efforts to improve learning, and, for this reason, these studies were not used toward answering the second research question.

Categorizing Interventions

To better understand the research conducted and to systematically code and analyze the studies, a subgroup of panelists and project staff categorized the 136 articles into the following five categories. It is important to note that the panel did not search for articles on these topical categories but instead searched for all studies of efforts to prepare young children for literacy success and derived the categories themselves from examining the articles that were identified in the search process. This contrasts with the NRP approach, which selected topics of study (e.g., phonemic awareness, phonics, technology, encouraging children to read, oral reading fluency, reading comprehension, teacher education, vocabulary) and then searched for interventions related to those topics. NRP necessarily took that approach to limit the scope of its investigation. Given the relatively limited number of intervention studies available to NELP, the research team decided to examine all such studies rather than particular subsets.

1. Helping Children Make Sense of Print—Cracking the Alphabetic Code and Teaching Letters and Words

2. Reading to and Sharing Books with Young Children

3. Parent and Home Programs for Improving Young Children's Literacy

4. Preschool and Kindergarten Programs

5. Language Enhancement.

Further Checks for Article Inclusion

Prior to finalizing the set of articles to be used to answer the second research question, the panelists implemented additional checks to ensure that all relevant studies that met the selection

criteria were identified and included in the synthesis. Panelists reviewed the reference lists of the 136 included articles, reviewed all studies included in the research review completed by Halle et al. (2003), and sent a complete list of articles to an external group of 14 expert reviewers nominated by the panelists. The review of the article reference lists resulted in 130 potentially relevant citations not previously reviewed. Abstracts for these additional articles were examined, resulting in full-text review of another 65 articles. The review of the studies in Halle et al. resulted in one more accepted article.

The review by the external experts identified four studies for review that had been missed, and two of these were accepted for inclusion. These items had been missed because of a discrepancy in the search terms across the PsycINFO and ERIC databases. As a result, the panel conducted additional searches of the PsycINFO databases using slightly revised age terminology.

In addition to these checks, several researchers had notified panel members with inquiries about specific research that they thought should be included, often submitting a list of articles or the articles themselves. In these cases, article citations were checked against the panel's lists, and individuals were notified about the status of an article's inclusion. If articles had been rejected, explanations were provided detailing the reasons for exclusion.

Revised Literature Searches

The PsycINFO database was searched again, this time using age terms that better matched the index of that database. ERIC was not searched again, because there had been no such mismatch.

The second search of PsycINFO repeated all the earlier search procedures and yielded the results reported in Tables 1.3 and 1.4. This identified 662 potential studies and, after the various screenings, expanded the total number of studies considered for question 1 to 299 and the number of studies considered for question 2 to 191.

Table 1.3. Records Generated in Revised Original Search of PsycINFO

Search Category	Records
Language	109
Cognition	65
Motivation	65
Schooling	76
Home and family	60
Word learning	89
Fluency	13
Reading comprehension	92
Miscellaneous	93

Table 1.4. Records Generated in Revised Question 2 Search of PsycINFO

Predictor Category	Records
AK	5
Language	26
Concepts about print	0
Environmental print	0
Invented spelling	0
Listening comprehension	4
Name writing	2
PA	10
Phonological STM	0
RAN	0
Verbal IQ	3
Visual memory	2
Visual perception	6
Literacy	18

Coding Scheme and Coding Studies

The coding scheme for the second research question was similar to that of the first one, except that articles were further coded for group information from experimental and quasiexperimental studies. (See the coding instrument, form 5, for group information codes.) Specifically, the panel developed codes relevant to the five intervention categories (Appendix 1.D) to aid in the investigation of any moderator effects that might be found for the various treatment effects.

Unit of Analysis and Data Analyses

The unit of analysis for the second research question was the ES obtained from independent groups as defined for the first research question. However, in this case, the ESs obtained were typically treatment-group contrasts with a control or comparison group, as compared with the within-group correlations used to answer the first research question. Effects from a single treatment-control comparison that were categorized as representing the same outcome construct were aggregated prior to analysis. ESs were compared using Cohen's *d*:

$$d = \frac{\overline{X}_t - \overline{X}_c}{s_{pooled}},$$

where

$\overline{X}_t$ = mean of the treatment group at posttest,

$\overline{X}_c$ = mean of the control group at posttest, and

s_{pooled} = pooled standard deviation.

This d was corrected for small sample bias using the following formula:

$$d' = \left(1 - \frac{3}{4N - 9}\right) d,$$

where

$N =$ total sample size $\left(\text{treatment} + \text{control}\right)$ and

$d =$ Cohen's d.

The SE associated with the adjusted ES estimate from each study is

$$SE_i = \sqrt{\frac{N_t + N_c}{N_t N_c} + \frac{d^2}{2\left(N_t + N_c\right)}},$$

where

$N_t =$ sample size of the treatment group,

$N_c =$ sample size of the control group, and

$d =$ adjusted Cohen's d.

The weight (w) was computed as the inverse of the square of the SE.

ESs were combined across independent groups assuming a random-effect model. Specifically, the homogeneity statistic Q was computed (under the fixed-effect assumption) using the following formula:

$$Q = \sum_{i=1}^{k} \left(w_i d_i^2\right) - \frac{\left(\sum_{i=1}^{k} w_i d_i\right)^2}{\sum w_i},$$

where

$k =$ number of studies contributing an effect,

$w_i =$ weight of individual study, and

$d_i =$ adjusted Cohen's d.

Using the Q statistic, the random-effect variance component was estimated using the following formula:

$$v = \frac{Q - k - 1}{\sum w_i - \frac{\sum w_i^2}{\sum w_i}},$$

where

Q = the homogeneity statistic,

k = total number of effects that comprise that estimate, and

w_i = effect-size weight.

This variance component was then added to the variance estimate for every ES, and the inverse weights (w_i) were recalculated for each study. ESs across the studies were combined by weighting each effect by this new weight, and the SE of this estimate was computed by taking the square root of the inverse of the sum of the new individual variance estimates (with the random-effect variance component added in) that comprised that effect. Finally, the panel determined that, to interpret an ES, a minimum of three studies must have contributed to the estimation of that effect. (ESs for single studies or combinations of two studies are included in some tables for information purposes or symmetry only; however, these statistics are neither analyzed nor discussed except to point out their inadequacy for interpretive purposes).

If the homogeneity analysis (Q statistic) showed that a particular set of ESs was heterogeneous (meaning that the likelihood that they all came from the same population of ESs was small), they were further analyzed using a set of predefined moderator variables that the panel developed and coded specific to each of the five categories of interventions. The moderator analyses were conducted using an analog to an analysis of variance (ANOVA) as described by Lipsey and Wilson (2001). Specifically, this technique partitions the total variability represented by the Q statistic into a between-subjects component that is attributable to a moderator and a within-subjects component that is considered residual variance, or variance unexplained by the moderator. If the between-subjects Q was significantly different from zero for our categorical moderators, ES estimates were obtained for each level of the moderator, and SE and 95 percent CIs were computed for each one. We interpreted nonoverlapping CIs as being statistically significant from each other, even though we realize that this is only a close approximation to null-hypothesis significance testing that is typically performed on two or more means. Specifically, within an ANOVA framework, a pooled error term is used in the denominator when estimating statistical significance. By using CIs estimated for each mean, it is not taking advantage of the increased power and stability of a pooled estimator. For example, it should be noted that partially overlapping 95 percent CIs may actually be statistically significant at $p < 0.05$. This is because each CI is based solely on the variance estimate (and SE) for that particular effect and

does not use a pooled estimate that is typically used when comparing two means. In the case of comparing two estimates, it will always be the case that, if the two CIs do not overlap, the difference between the two means will be significant at $p < 0.05$. However, it is also possible that, when comparing two means that represent levels of a factor and this factor has three or more levels, two estimates found to have nonoverlapping 95 percent CIs would have been found not to be statistically different at $p > 0.05$ using a pooled estimator. Specifically, if the two ES estimates being compared have smaller variance estimates than a pooled estimate across all levels of that factor, the confidence-interval approach would claim statistical significance, while the approach using the pooled estimator would not. In general, however, the use of CIs as a means of discussing significant effects is a conservative, although admittedly less powerful, approach.

Effect Sizes

ESs are useful because they are standardized and can be compared across studies. In this report, the strength of an ES is characterized as small if it ranges up to 0.30 (meaning as big as 20 percent of a standard deviation), moderate if it is in the 0.50–0.79 range, and large (meaning a difference at least half a standard deviation or larger) if it is over 0.80 (Cohen, 1988).

ESs are a function of not only the experimental intervention, but the instruction being provided to the comparison children as well. True control groups are rare in education, and individual teachers and parents vary a great deal in their teaching and interaction routines. The intervention studies examined here contrast performance in a variety of comparison situations. In some cases, the researchers structure an alternative treatment for the comparison students, usually to enhance the contrast. In far more cases, the researcher accepts the naturally occurring variation in existing classrooms and households and intervenes by enhancing some aspect of support in the experimental situations. This means that the comparison groups may be providing some version of the intervention, albeit without the intensifying help of the researcher. For example, in studies of book sharing, the researcher might provide particular books for the experimental classrooms or households, might teach teachers and parents particular ways to share books with children, or might impose a specific schedule to increase the amount of book sharing that takes place. The comparison teachers and parents, left to their own devices, might also be reading to children during the study, though one suspects that they would not do it as much or as well as the experimental teachers and parents. ESs tend to be larger when interventions are compared with true controls and smaller when they are compared with alternate treatments.

Methodology for Mediators and Moderators

If, for a particular intervention and outcome variable, there is a significant average effect across a collection of studies, it is worthwhile to see what can be deduced about the nature of that effect. Toward that end, homogeneity analysis is used to determine whether the variation in individual effects are just normal sampling error or whether they might be the result of how the various research studies were conducted, differences in features of the intervention, or differences in the children themselves. If the homogeneity analysis indicates that the individual study effects are from different distributions, further analysis was warranted to try to find patterns of differences in effects across these studies. All studies were coded with regard to the participants,

interventions, contexts, and research variables, and differences in these variables were explored to help explain the variation in ESs (to try to understand why different versions of similar interventions differ in their degree of effectiveness).

In addition to this standard coding of studies, panelists worked in subgroups relevant to the subcategories of interventions. These subgroups of panelists identified additional comparisons unique to the set of studies in each category to determine whether variations in the interventions were more or less successful under various conditions.

Appendix 1.A: Original Search Categories and Terms

Search Categories

1. **Language.** This set identifies *all* articles dealing with language, language abilities, language development, and language learning. These are all synonyms and related terms. They should be linked together with *or* in a search—meaning that we will identify a set of all articles that focuses on any one of the following topics:
   child language
   dialect
   distinctive features (language)
   expressive language
   grammar
   intonation
   language
   language acquisition
   language development
   language fluency
   language impairments
   language learning
   language processing
   language skills
   language typology
   lexical development
   lexicology
   listening comprehension
   metalinguistics
   morphology
   oral language
   phonemic
   phonemic awareness
   phonetic
   phonological awareness
   phonological processing
   phonological sensitivity
   phonology
   pragmatics
   psycholinguistics
   receptive language
   semantics
   semiotics
   speech
   speech communication
   speech skills
   syntax
   verbal communication
   verbal development
   vocabulary

2. **Cognition.** This set identifies *all* articles dealing with cognitive abilities (excluding language issues), including learning, perception, memory, and intellect. These are all synonyms and related terms. They should be linked together with *or* in a search—meaning that we will identify a set of all articles that focuses on any one of the following topics:
   aptitude
   attention
   attention control
   attention span
   auditory perception
   automatic processing
   automaticity
   cognition
   cognitive ability
   cognitive behavior
   cognitive development
   cognitive flexibility
   cognitive functioning
   cognitive load
   cognitive models
   cognitive processes
   cognitive psychology
   cognitive research
   cognitive skills
   cognitive strategies
   cognitive structures
   cognitive style
   concept development
   concept formation
   conceptual change
   conceptual tempo
   encoding
   information processing
   intelligence
   IQ
   learning processes
   long-term memory
   memorization
   memory
   metacognition
   perception
   rapid naming
   recall
   recognition
   retention
   schema
   schema theory
   schemata

short-term memory
social cognition
visual perception

3. **Motivation.** This set identifies all terms that are related to motivation, interest, attitude, and affective factors in learning. These are all synonyms and related terms. They should be linked together with *or* in a search—meaning that we will identify a set of all articles that focuses on any one of the following topics:
   affective domain
   aspiration
   attitude
   curiosity
   external motivation
   fear of success
   goal orientation
   incentives
   intention
   interest
   interests
   internal motivation
   learning motivation
   motivation
   motivation techniques
   praise
   reading attitudes
   reading interests
   reading motivation
   rewards
   satisfaction
   self motivation
   social desirability effects
   success

4. **Schooling.** This set identifies any influences on early literacy by any kind of schooling or care arrangement or instructional approach or program. These are all synonyms and related terms. They should be linked together with *or* in a search—meaning that we will identify a set of all articles that focuses on any one of the following topics:
   ancillary school services
   child care
   child caregivers
   day-care centers
   day-care effects
   early childhood education
   early experience
   early identification
   early intervention
   Even Start
   family day care

family literacy
Head Start
home schooling
individualized reading
initial teaching alphabet
Kenan model
language experience approach
parents as teachers
prekindergarten classes
prekindergarten teachers
preschool clinics
preschool curriculum
preschool experience
preschool programs
preschool teachers
reciprocal teaching
special education
sustained silent reading

5. **Home and family.** This set identifies any environmental influences in the home. These are all synonyms and related terms. They should be linked together with *or* in a search—meaning that we will identify a set of all articles that focuses on any one of the following topics:
   brothers
   caregiver interaction
   family
   family (sociological unit)
   family environment
   family influence
   family life
   family literacy
   family problems
   family relationships
   fathers
   grandparents
   home experiences
   lower-class parents
   middle-class parents
   mothers
   parent aspiration
   parent attitude
   parent background
   parent-child relationship
   parent education
   parent influence
   parent participation
   parent-school relations
   parental attitudes

parenthood education
parenting
parenting skills
parents
siblings
sisters

6. **Word learning.** This set identifies all information about the learning of words and word parts in reading and writing. Anything dealing with decoding the printed word or encoding (spelling) is included here. They should be linked together with *or* in a search—meaning that we will identify a set of all articles that focuses on any one of the following topics:
   alphabets
   basic vocabulary
   consonants
   context clues
   decoding
   grapheme
   invented spelling
   letters (alphabet)
   morphemes
   morphophonemic
   orthographic symbols
   pattern recognition
   phoneme-grapheme correspondence
   phonemes
   phonemic awareness
   phonics
   phonology
   rhyming
   sight method
   sight vocabulary
   spelling
   structural analysis
   syllables
   vowels
   word lists
   word recognition
   word study skills

7. **Fluency.** This set is to identify all information about the learning of fluency (speed, accuracy, expression) in reading. Anything dealing with fluency in oral and silent reading is included here. They should be linked together with *or* in a search—meaning that we will identify a set of all articles that focuses on any one of the following topics:
   context clues
   eye voice span
   fluency
   inner speech (subvocal)

intonation
miscue analysis
oral interpretation
oral reading
prosody
reading aloud to others
reading rate
silent reading

8. **Reading comprehension.** This set identifies all information about the learning of fluency (speed, accuracy, expression) in reading. Anything dealing with fluency in oral and silent reading is included here. They should be linked together with *or* in a search—meaning that we will identify a set of all articles that focuses on any one of the following topics:
   comprehension
   content-area reading
   critical reading
   reader response
   reader-text relation
   schema theory
   story grammar
   text structure

9. **Miscellaneous**. This set identifies all information about reading and writing that is not included in the other sets (including writing and concepts of print). They should be linked together with *or* in a search—meaning that we will identify a set of all articles that focuses on any one of the following topics:
   concept of word
   concepts of print
   conventions of print
   developmental delays
   environmental print
   directionality
   prevention
   reading readiness
   special-need students
   story reading
   reading habits
   reading process
   reading strategies
   writing (composition)
   writing ability
   writing achievement
   writing attitudes
   writing contexts
   writing development
   writing difficulties
   writing evaluation
   writing improvement

writing instruction
writing motivation
writing processes
writing readiness
writing research
writing skills
writing strategies

10. **Age group.** This set identifies children by age or grade level. We want to find anything written on children from birth to age 5, including preschool and kindergarten. They should be linked together with *or* in a search—meaning that we will identify a set of all articles that focuses on any one of the following topics:
    early childhood education
    early experience
    infants
    kindergarten children
    preschool children
    toddlers
    young children

11. **Literacy.** This set identifies any articles that deal with reading and writing. They should be linked together with *or* in a search—meaning that we will identify a set of all articles that focuses on any one of the following topics:
    language arts
    literacy
    beginning reading
    content-area reading
    corrective reading
    critical reading
    early reading
    functional reading
    independent reading
    oral reading
    recreational reading
    remedial reading
    silent reading
    story reading
    reading ability
    reading achievement
    reading comprehension
    decoding
    reading diagnosis
    reading difficulties
    reading failure
    reading improvement
    reading instruction
    reading motivation
    reading processes

reading programs
reading readiness
reading research
reading skills
reading strategies
reading-writing relationship
writing (composition)
writing ability
writing achievement
writing attitudes
writing contexts
writing development
writing difficulties
writing evaluation
writing improvement
writing instruction
writing motivation
writing processes
writing readiness
writing research
writing skills
writing strategies

Searches

1. Role of language in early reading development
   Pool 1: Link all items in set 1 by *or*.
   Pool 2: Link all items in set 10 by *or*.
   Pool 3: Link all items in set 11 by *or*.
   Link pools 1, 2, and 3.

2. Role of cognitive development in early reading development
   Pool 1: Link all items in set 2 by *or*.
   Pool 2: Link all items in set 10 by *or*.
   Pool 3: Link all items in set 11 by *or*.
   Link pools 1, 2, and 3.

3. Role of motivational factors in early reading development
   Pool 1: Link all items in set 3 by *or*.
   Pool 2: Link all items in set 10 by *or*.
   Pool 3: Link all items in set 11 by *or*.
   Link pools 1, 2, and 3.

4. Role of schooling or educational effort in early reading development
   Pool 1: Link all items in set 4 by *or*.
   Pool 2: Link all items in set 10 by *or*.
   Pool 3: Link all items in set 11 by *or*.
   Link pools 1, 2, and 3.

5. Role of home and family on early reading development
   Pool 1: Link all items in set 5 by *or*.
   Pool 2: Link all items in set 10 by *or*.
   Pool 3: Link all items in set 11 by *or*.
   Link pools 1, 2, and 3.

6. Role of word knowledge (decoding) in early reading development
   Pool 1: Link all items in set 6 by *or*.
   Pool 2: Link all items in set 10 by *or*.
   Pool 3: Link all items in set 11 by *or*.
   Link pools 1, 2, and 3.

7. Role of fluency in early reading development
   Pool 1: Link all items in set 7 by *or*.
   Pool 2: Link all items in set 10 by *or*.
   Pool 3: Link all items in set 11 by *or*.
   Link pools 1, 2, and 3.

8. Role of comprehension in early reading development
   Pool 1: Link all items in set 8 by *or*.
   Pool 2: Link all items in set 10 by *or*.
   Pool 3: Link all items in set 11 by *or*.
   Link pools 1, 2, and 3.

9. Role of miscellany in early reading development
   Pool 1: Link all items in set 9 by *or*.
   Pool 2: Link all items in set 10 by *or*.
   Pool 3: Link all items in set 11 by *or*.
   Link pools 1, 2, and 3.

Appendix 1.B: NELP Coding Instrument

Form 1: Report Identification

Article ID No: ___

1.1. Article ID No.:___

1.2. Citation

Author(s):

Title:

Source:

Year:

Volume (Issue):

Page Numbers:

Abstract: (copy/paste from abstract list)

1.3. Coder ID

Coder 1:
Coder 2:

1.4. Report Rejected: *(Check # 1 or 2)*

❒ 1. Accepted
❒ 2. Rejected
If rejected, give reason: _____

1.5. Research Question Relevance: *(Check all that apply)*

❒ 1. RQ1
❒ 2. RQ2
❒ 3. RQ3
❒ 4. RQ4

Form 2: Setting

Article ID No._____

2.1. Country(ies) sample drawn from: *(check # 1 or 2)*

❒ 1. U.S.
❒ 2. Other(s): _____

2.2. Population Density *(Check all that apply)*

❒ Urban
❒ Suburban
❒ Rural
❒ Mixed
❒ Unknown

2.3. Grade Level(s)/Ages at Entry *(Check all that apply)*

❒ Infants (up to 12 months)
❒ Toddlers (12 to 24 months)
❒ Two-year-olds
❒ Three-year-olds
❒ Four-year-olds
❒ Five-year-olds (not in Kindergarten)
❒ K
❒ Mixed
❒ Other _____

2.4. Grade Level(s)/Ages throughout study (Check all that apply)

- ❒ Infants (up to 12 months)
- ❒ Toddlers (12 to 24 months)
- ❒ Two-year-olds
- ❒ Three-year-olds
- ❒ Four-year-olds
- ❒ Five-year-olds (not in Kindergarten)
- ❒ K
- ❒ 1
- ❒ 2
- ❒ 3
- ❒ Mixed
- ❒ Other:_____

2.5. Program Type (Check all that apply)

- ❒ Preschool
- ❒ ___Public
- ❒ ___Private
- ❒ ___Unknown
- ❒ Head Start
- ❒ Child Care
- ❒ Even Start
- ❒ Kindergarten
- ❒ Other:_____
- ❒ None

2.6. Program Setting (Check all that apply)

- ❒ Home-based
- ❒ Center-based
- ❒ School-based
- ❒ Unknown

2.7. Duration of Program (Check all that apply)

- ❒ Half day
- ❒ Full day
- ❒ Unknown

2.8. Home Setting (check # 1 or 2)

- ❒ 1. Yes
- ❒ 2. No

Form 3: Demographics

Article ID No._____

3.1. Number of groups with demographic information:_____
(If more than one, name the groups, e.g. Treatment, Control):
Enter the group names below_____

Item #	Demographic Information	Total of All Groups	Group 1 _____	Group 2 _____	Group 3 _____	Group 4 _____
3.2	Number of Subjects (beginning of study)					
3.3	Number of Subjects (end of study)					
3.4	Boys (Do the Math)	Number: _____ Percent: _____	Number: _____ Percent: _____	Number: _____ Percent: _____	Number: _____ Percent: _____	Number: _____ Percent: _____
3.5	Girls (Do the Math)	Number: _____ Percent: _____	Number: _____ Percent: _____	Number: _____ Percent: _____	Number: _____ Percent: _____	Number: _____ Percent: _____
3.6	*Mean age* in MONTHS (beginning)					
3.7	*Age range* in MONTHS (beginning)					
3.8	SES	*(place a check next to all that apply)* ❒ Low ❒ Other_____ ❒ Unknown	*(place a check next to all that apply)* ❒ Low ❒ Other_____ ❒ Unknown	*(place a check next to all that apply)* ❒ Low ❒ Other_____ ❒ Unknown	*(place a check next to all that apply)* ❒ Low ❒ Other_____ ❒ Unknown	*(place a check next to all that apply)* ❒ Low ❒ Other_____ ❒ Unknown
3.9	Ethnicity/Race (Give percent, if known, and do the math)	*(place a check next to all that apply and give percent of each, if known)* ❒ Lat/Hisp ____ ❒ AfrAm ____ ❒ Cauc ____ ❒ Other_____ ❒ Unknown	*(place a check next to all that apply and give percent of each, if known)* ❒ Lat/Hisp ____ ❒ AfrAm ____ ❒ Cauc ____ ❒ Other_____ ❒ Unknown	*(place a check next to all that apply and give percent of each, if known)* ❒ Lat/Hisp ____ ❒ AfrAm ____ ❒ Cauc ____ ❒ Other_____ ❒ Unknown	*(place a check next to all that apply and give percent of each, if known)* ❒ Lat/Hisp ____ ❒ AfrAm ____ ❒ Cauc ____ ❒ Other_____ ❒ Unknown	*(place a check next to all that apply and give percent of each, if known)* ❒ Lat/Hisp ____ ❒ AfrAm ____ ❒ Cauc ____ ❒ Other_____ ❒ Unknown

Item #	Demographic Information	Total of All Groups	Group 1 _____	Group 2 _____	Group 3 _____	Group 4 _____
3.10	Language(s)	*(Check either #1 or 2 for each or #3 if unknown)* *Home:* ❒ 1. English ❒ 2. Other: _____ ❒ 3. Unknown *Instruction:* ❒ 1. English ❒ 2. Other: _____ ❒ 3. Unknown	*(Check either #1 or 2 for each or #3 if unknown)* *Home:* ❒ 1. English ❒ 2. Other: _____ ❒ 3. Unknown *Instruction:* ❒ 1. English ❒ 2. Other: _____ ❒ 3. Unknown	*(Check either #1 or 2 for each or #3 if unknown)* *Home:* ❒ 1. English ❒ 2. Other: _____ ❒ 3. Unknown *Instruction:* ❒ 1. English ❒ 2. Other: _____ ❒ 3. Unknown	*(Check either #1 or 2 for each or #3 if unknown)* *Home:* ❒ 1. English ❒ 2. Other: _____ ❒ 3. Unknown *Instruction:* ❒ 1. English ❒ 2. Other: _____ ❒ 3. Unknown	*(Check either #1 or 2 for each or #3 if unknown)* *Home:* ❒ 1. English ❒ 2. Other: _____ ❒ 3. Unknown *Instruction:* ❒ 1. English ❒ 2. Other: _____ ❒ 3. Unknown
3.11	Family Structure	*place a check next to all that apply* ❒ Single Parent ❒ Two Parent ❒ Teen Parent ❒ Other _____ ❒ Unknown	*place a check next to all that apply* ❒ Single Parent ❒ Two Parent ❒ Teen Parent ❒ Other _____ ❒ Unknown	*place a check next to all that apply* ❒ Single Parent ❒ Two Parent ❒ Teen Parent ❒ Other _____ ❒ Unknown	*place a check next to all that apply* ❒ Single Parent ❒ Two Parent ❒ Teen Parent ❒ Other _____ ❒ Unknown	*place a check next to all that apply* ❒ Single Parent ❒ Two Parent ❒ Teen Parent ❒ Other _____ ❒ Unknown
3.12	Maternal Education (Give percent, if known, and do the math)	*(place a check next to all that apply and give percent, if known):* ❒ Less than high school:_____ ❒ Some high school:_____ ❒ High school diploma:_____ ❒ GED:_____ ❒ Vocational: _____ ❒ Some college:_____ ❒ College graduate:_____ ❒ Other: _____ ❒ Unknown	*(place a check next to all that apply and give percent, if known):* ❒ Less than high school:_____ ❒ Some high school:_____ ❒ High school diploma:_____ ❒ GED:_____ ❒ Vocational: _____ ❒ Some college:_____ ❒ College graduate:_____ ❒ Other: _____ ❒ Unknown	*(place a check next to all that apply and give percent, if known):* ❒ Less than high school:_____ ❒ Some high school:_____ ❒ High school diploma:_____ ❒ GED:_____ ❒ Vocational: _____ ❒ Some college:_____ ❒ College graduate:_____ ❒ Other: _____ ❒ Unknown	*(place a check next to all that apply and give percent, if known):* ❒ Less than high school:_____ ❒ Some high school:_____ ❒ High school diploma:_____ ❒ GED:_____ ❒ Vocational: _____ ❒ Some college:_____ ❒ College graduate:_____ ❒ Other: _____ ❒ Unknown	*(place a check next to all that apply and give percent, if known):* ❒ Less than high school:_____ ❒ Some high school:_____ ❒ High school diploma:_____ ❒ GED:_____ ❒ Vocational: _____ ❒ Some college:_____ ❒ College graduate:_____ ❒ Other: _____ ❒ Unknown

Item #	Demographic Information	Total of All Groups	Group 1 _____	Group 2 _____	Group 3 _____	Group 4 _____
3.13	Child Characteristics	*(place a check next to all that apply and specify the items marked, if known):*	*(place a check next to all that apply and specify the items marked, if known):*	*(place a check next to all that apply and specify the items marked, if known):*	*(place a check next to all that apply and specify the items marked, if known):*	*(place a check next to all that apply and specify the items marked, if known):*
		❒ Perinatal/ Neonatal Conditions: _____	❒ Perinatal/ Neonatal Conditions: _____	❒ Perinatal/ Neonatal Conditions: _____	❒ Perinatal/ Neonatal Conditions: _____	❒ Perinatal/ Neonatal Conditions: _____
		❒ ESL	❒ ESL	❒ ESL	❒ ESL	❒ ESL
		❒ Psychopathology: _____	❒ Psychopathology: _____	❒ Psychopathology: _____	❒ Psychopathology: _____	❒ Psychopathology: _____
		❒ Premature birth	❒ Premature birth	❒ Premature birth	❒ Premature birth	❒ Premature birth
		❒ Developmental Delay: _____	❒ Developmental Delay: _____	❒ Developmental Delay: _____	❒ Developmental Delay: _____	❒ Developmental Delay: _____
		❒ Other: _____	❒ Other: _____	❒ Other: _____	❒ Other: _____	❒ Other: _____
		❒ Unspecified	❒ Unspecified	❒ Unspecified	❒ Unspecified	❒ Unspecified
3.14	Parent Characteristics	*(place a check next to all that apply and specify the items marked, if known):*	*(place a check next to all that apply and specify the items marked, if known):*	*(place a check next to all that apply and specify the items marked, if known):*	*(place a check next to all that apply and specify the items marked, if known):*	*(place a check next to all that apply and specify the items marked, if known):*
		❒ History of Reading Problems: _____	❒ History of Reading Problems: _____	❒ History of Reading Problems: _____	❒ History of Reading Problems: _____	❒ History of Reading Problems: _____
		❒ ESL	❒ ESL	❒ ESL	❒ ESL	❒ ESL
		❒ Psychopathology: _____	❒ Psychopathology: _____	❒ Psychopathology: _____	❒ Psychopathology: _____	❒ Psychopathology: _____
		❒ Income _____	❒ Income _____	❒ Income _____	❒ Income _____	❒ Income _____
		❒ Parental Education: _____	❒ Parental Education: _____	❒ Parental Education: _____	❒ Parental Education: _____	❒ Parental Education: _____
		❒ Other: _____	❒ Other: _____	❒ Other: _____	❒ Other: _____	❒ Other: _____
		❒ Unspecified	❒ Unspecified	❒ Unspecified	❒ Unspecified	❒ Unspecified
3.15	Other Demographics					

Form 4: Research Design

Article ID No._____

4.1. Research Type *(Check one of the following)*

- ❒ 1. Experimental Designs — Interventions ➔ Complete Forms 5 & 7
- ❒ 2. Experimental Designs — Other ➔ Complete Forms 5 & 7
- ❒ 3. Correlational Designs ➔ Complete Forms 6 & 8
- ❒ 4. Intervention study with correlations ➔ Complete Forms 5, 6, & 7
- ❒ 5. Qualitative Design ➔ Discontinue
- ❒ 6. Other group designs with correlations ➔ Complete Forms 5, 6, & 7

Form 5: Experimental Designs — Interventions

Article ID No._____

5.1. Group Design Study

- ❒ Experimental *(Check all that apply)*
- ❒ ___Control group
- ❒ ___No control group
- ❒ ___Matched
- ❒ ___Not matched

- ❒ Quasi-experimental *(Check all that apply)*
- ❒ ___Control group
- ❒ ___No control group
- ❒ ___Matched
- ❒ ___Not matched

5.1.1. What Type of Controls? *(check one of the following)*

- ❒ 1. Pre/Post
- ❒ 2. Historical
- ❒ 3. No Treatment Controls
- ❒ 4. Other_____

5.1.2. Is the study design flawed or confounded, if so what is the reason *(check one of the following)*

- ❒ 1. Fatal Flaw _____
- ❒ 2. Confounded _____
- ❒ 3. Other:_____

5.2. Measurement Design *(check one of the following)*

- ❒ 1. Pre-test and Post-test
- ❒ 2. Post-test only
- ❒ 3. Pre-test/Post-test/Follow-up
- ❒ 4. Other:_____

5.3. Number of treatment groups:_____

5.4. Number of treatments:_____

5.5. Number of control groups:_____

5.6. Selection restrictions (e.g., low or high reading score(s)): _____

_____

5.7. Description of the intervention(s) or control group instruction(s):

Group 1	**Group 2**	**Group 3**	**Group 4**
_____	_____	_____	_____

5.8. Level of intervention *(place a check next to all that apply)*

- ❒ Individual
- ❒ Small Group
- ❒ Full Class (large group)

5.9. Implementers — for each group *(place a check next to all that apply)*

Group 1 _____	**Group 2** _____	**Group 3** _____	**Group 4** _____
❒ Evaluator/researcher	❒ Evaluator/researcher	❒ Evaluator/researcher	❒ Evaluator/researcher
❒ Other researchers	❒ Other researchers	❒ Other researchers	❒ Other researchers
❒ Practitioners/Teachers	❒ Practitioners/Teachers	❒ Practitioners/Teachers	❒ Practitioners/Teachers
❒ Parents	❒ Parents	❒ Parents	❒ Parents
❒ Volunteers	❒ Volunteers	❒ Volunteers	❒ Volunteers
❒ Technology	❒ Technology	❒ Technology	❒ Technology
❒ Other	❒ Other	❒ Other	❒ Other

5.9.1. Intervention Settings —- for each group *(place a check next to all that apply)*

Group 1 _____	**Group 2** _____	**Group 3** _____	**Group 4** _____
❒ Classroom	❒ Classroom	❒ Classroom	❒ Classroom
❒ Pull out of Classroom	❒ Pull out of Classroom	❒ Pull out of Classroom	❒ Pull out of Classroom
❒ University Lab	❒ University Lab	❒ University Lab	❒ University Lab
❒ Home	❒ Home	❒ Home	❒ Home
❒ Other _____	❒ Other _____	❒ Other _____	❒ Other _____

5.10. Duration of Intervention *(for each group, if given)*

	Group 1 _____	**Group 2** _____	**Group 3** _____	**Group 4** _____
Number of weeks by individual/group				
Number of sessions per week by individual/group				
Number of minutes per session by individual or group				
Total number of sessions by individual/group				
Unknown or Not Applicable (i.e. regular classroom instruction)				

5.10.1 Length of Long-term Intervention *(check one)*

- ❒ 1. Less than an academic year
- ❒ 2. Academic year
- ❒ 3. Whole calendar year
- ❒ 4. More than 12 months but less than 24 months
- ❒ 5. More than 2 years
- ❒ 6. Other _____

5.11. Attrition:

Was there attrition of subjects? *(check one of the following)*

- ❒ 1. Yes
- ❒ 2. No
- ❒ 3. Unknown

Was there differential loss of subjects across groups? *(check one of the following)*

- ❒ 1. Yes
- ❒ 2. No
- ❒ 3. Unknown

Did retained subjects differ from lost subjects? *(check one of the following)*

- ❒ 1. Yes. If yes, the difference:_____
- ❒ 2. No
- ❒ 3. Unknown

5.12. Comparison Group Rating (for control group(s) only) *(Check all that apply for each group)*

Group 1 _____	**Group 2** _____	**Group 3** _____	**Group 4** _____
❒ Active Control	❒ Active Control	❒ Active Control	❒ Active Control
❒ Alternative Intervention	❒ Alternative Intervention	❒ Alternative Intervention	❒ Alternative Intervention
❒ Initial Group Equivalency	❒ Initial Group Equivalency	❒ Initial Group Equivalency	❒ Initial Group Equivalency
❒ Control change agents	❒ Control change agents	❒ Control change agents	❒ Control change agents
❒ Low attrition at post	❒ Low attrition at post	❒ Low attrition at post	❒ Low attrition at post
❒ Doesn't apply/Not a control group	❒ Doesn't apply/Not a control group	❒ Doesn't apply/Not a control group	❒ Doesn't apply/Not a control group
❒ Other _____	❒ Other _____	❒ Other _____	❒ Other _____

5.13. Durability of Effects *(Check one of the following; Place a 0 in any empty fields,* for example: _0_ days _0_ weeks _0_ months _3_ years) _____

❒ 1. Immediate post testing
❒ 2. Post testing _____ days _____weeks _____months _____years

5.14. Amount of training and type of support for implementers: _____

_____

5.15. Characteristics of training *(Check all that apply)*

❒ Use of manual
❒ Supervision/consultation
❒ Audio/videotapes
❒ Informal or formal training sessions
❒ Other:_____
❒ Unknown

5.16. Fidelity of Implementation *(Check all that apply)*

❒ Ongoing supervision/consultation and observations
❒ Audiotapes
❒ Videotapes
❒ Use of manual
❒ None
❒ Unknown
❒ Other:_____

5.17. What is the Intervention Focus (Outcome)? *(Check all that apply)*

- ❒ Oral language (general vs. specific)
- ❒ Phonological Awareness (what level: rhyme, syllable, phoneme, letter sounds based on audition)
- ❒ Print Awareness (letter names, letter sounds (based on print), or other like CAP)
- ❒ Comprehensive Literacy (i.e., no specific target)
- ❒ General Stimulation (projects like Abecedarian)
- ❒ ESL
- ❒ Classroom Environment Enhancement for Literacy
- ❒ Other_____

5.17.1 What is the Intervention Focus (Material/Style)? *(Check all that apply)*

- ❒ Materials only
- ❒ Systematic Instructional Strategy
- ❒ Direct Instruction (not directed by the child)
- ❒ Other_____

5.17.2 Who is the Intervention Intended to Target (Age)? *(Check all that apply)*

- ❒ Toddlers (i.e., children not in preschool, <3 years)
- ❒ Preschooler (3 to 5-year-olds)
- ❒ Kindergarten
- ❒ Other_____

5.17.3 Who is the Intervention Intended to Target (Special Populations)? *(Check all that apply)*

- ❒ Global
- ❒ At-Risk only
- ❒ Not at-risk only
- ❒ SLL
- ❒ Other_____

Form 6: Non-Experimental Designs — Correlational

Article ID No._____

6.1. Restriction Range

Any reason to think that sample selection factors would restrict performance ranges or variability? *(check either #1 or 2 and provide an explanation if #1 is checked)*

❒ 1. Yes_____

❒ 2. No

6.2. Measurement Issues

Any important alterations to the data for the purposes of analysis? *(check either #1 or 2 and provide an explanation if #1 is checked)*

❒ 1. Yes_____

❒ 2. No

Form 6: Non-Experimental Designs — Correlations & Regressions

Article ID No._____

Table 6.3 Zero-order correlations between preschool predictor variables and literacy outcomes

Article ID #	Preschool Predictor Variable	PPV Category	Age/Grade when measured	Literacy Outcome	Literacy Category

Article ID No._____

Table 6.4 Semi-Partial correlations between preschool predictor variables and literacy outcomes

Article ID #	Variables Controlled	Preschool Predictor Variable	PPV Category	Age/Grade when measured	Literacy Outcome
	❒ IQ (non-Verbal) ❒ Other _____				
	❒ IQ (non-Verbal) ❒ Other _____				
	❒ IQ (non-Verbal) ❒ Other _____				
	❒ IQ (non-Verbal) ❒ Other _____				

	Age/Grade when measured	Correlation	P value	N (number of subjects)

	Literacy Category	Age/Grade when measured	R2	P value	N (number of subjects)

Form 7: Measurement Information — Intervention Designs

Article ID No._____

Table 7.1 Measurement Information – Intervention Designs

Test Name	Test Category	Test Reliability	Test Type *(check one for each test)*	Groups	Pretest Mean	Pre-test SD	Pretest N for each group	Post-test Mean	Post-test SD	Adjusted Post-test Mean *(only if pretest is covariate)*
		❒ 1. _____ ❒ 2. Cited reference in text ❒ 3. NA	❒ 1. Published ❒ 2. Unpublished ❒ 3. Unknown	1 2 3 4						
		❒ 1. _____ ❒ 2. Cited reference in text ❒ 3. NA	❒ 1. Published ❒ 2. Unpublished ❒ 3. Unknown	1 2 3 4						

Posttest N for each group	Time since Pretest (months)	Follow-up 1 Mean	Follow-up 1 SD	Follow-up 1 N for each group	Time since Posttest *(months)*	Follow-up 2 Mean	Follow-up 2 SD	Follow-up 2 N for each group	Time since Follow-up 1 *(months)*	Pre/ Post Interaction p value	Effect Size

Appendix 1.C: Outcome and Predictor Variables

Table 1.C.1. Variables and Descriptions

Variable	Description
AK	Knowledge of letter names or letter sounds, measured with recognition or naming test. Typically assessed with measure developed by investigator.
Arithmetic	Ability to perform mathematical operations, such as addition, subtraction, or counting, and knowledge of numbers. Assessed with measure developed by investigator or, more commonly, with standardized tests, such as the Peabody Individual Achievement Test, mathematics subtest, or Woodcock-Johnson Tests of Achievement®, applied problems subtest.
Concept knowledge	Knowledge of general concepts, such as colors, comparatives, directions, materials, positions, quantities, relationships, sequences, shapes, sizes, social and emotional states, characteristics, textures and time. Measured with a standardized test, such as the Bracken Basic Concept Scale.
Concepts about print	Knowledge of print conventions (e.g., left–right, front–back) and concepts (book cover, author, text). Assessed with either measure developed by investigator or using measure, such as Clay's Concepts About Print Test.
Decoding nonwords	Use of symbol-sound relations to verbalize pronounceable nonwords (e.g., "gleap," "taip"). Typically measured with a standardized measure, such as the Word Attack subtest of the Woodcock Reading Mastery Test.
Decoding not otherwise specified (NOS)	Use of symbol-sound relations to verbalize real words, pronounceable nonwords, or both. Sometimes assessed using a measure developed by investigator, and sometimes a combination of two decoding tests, such as both Word Attack and Word Identification from the Woodcock Reading Mastery Test. Often insufficient information provided to determine exact nature of decoding task.
Decoding words	Use of symbol-sound relations to verbalize real words or use of orthographic knowledge to verbalize sight words (e.g., "have," "give," "knight"). Typically assessed with a standardized measure, such as the Word Identification subtest of the Woodcock Reading Mastery Test.
Environmental print	Ability to identify product or company name for common product or establishment (e.g., "Coke," "McDonalds").
Invented spelling	Ability to use sound-symbol relations but not necessarily orthographic rules to write words (e.g., "BK" for bike, "RM" for arm).
IQ	Scores from full-scale intelligence measures, such as the Wechsler Preschool and Primary Scales of Intelligence™ or Stanford-Binet Intelligence Scale.

Variable	Description
Oral language	Ability to produce, comprehend, or both aspects of spoken language, including semantics, syntax, or both. Often measured by a standardized test, such as the Peabody Picture Vocabulary Test or the Clinical Evaluation of Language Fundamentals®.
Performance IQ	Scores from nonverbal subtests or subscales from intelligence measures, such as the Wechsler Preschool and Primary Scales of Intelligence or Stanford-Binet Intelligence Scale.
PA	Ability to detect, manipulate, or analyze components of spoken words independent of meaning. Examples include detection of common onsets between words (alliteration detection) or common rime units (rhyme detection); combining syllables, onset rimes, or phonemes to form words; deleting sounds from words; counting syllables or phonemes in words; or reversing phonemes in words. Often assessed with a measure developed by the investigator, but sometimes assessed with a standardized test, such as the Comprehensive Test of Phonological Processing.
Phonological NOS	Phonological task with insufficient information provided to determine whether PA, phonological memory, or a combination.
Phonological STM	Ability to remember spoken information for a short period of time. Typical tasks include digit span, sentence repetition, and nonword repetition from both investigator-created measures and standardized tests.
Print awareness	Tasks combining elements of AK, concepts about print, and protodecoding (beginning or early decoding).
RAN letters or digits	Rapid naming of sequentially repeating random sets of letters, digits, or both. Often assessed with investigator-created measure.
RAN objects or colors	Rapid naming of sequentially repeating random sets of pictures of objects (e.g., "car," "tree," "house," "man") or colors. Often assessed with investigator-created measure.
Readiness	Composite measure including combinations of aspects of AK, concepts of print, vocabulary, memory, and PA. Often insufficient information provided to determine exact content of measure.
Reading comprehension	Measures of comprehension of meaning of written language passages. Typically measured with standardized test, such as the Passage Comprehension subtest of the Woodcock Reading Mastery Test.
Reading NOS	Measure of reading with insufficient information provided to determine whether decoding, comprehension, or both was assessed.
Spelling	Ability to use sound-symbol relations and orthographic rules to write words using conventional spelling.

Variable	Description
Visual memory	Short-term recall of visually presented information (e.g., recall of object or shape presented to child).
Visual motor	Ability to copy or draw figure or shape from a model.
Visual perception	Ability to match or discriminate visually presented symbols.
Writing or writing name	Ability to write letters in isolation on request or write own name. Often assessed with measure created by examiner.

Appendix 1.D: Intervention Search Categories and Terms

1. Predictor categories and terms

Alphabet Knowledge (predictor subcategory)

alphabets or (letter identification) or letters or alphabet

Language (predictor subcategory)

(child language) or dialect or (distinctive features) or (expressive language) or grammar or language or (language acquisition) or (language development) or (language fluency) or (language impairments) or (language learning) or (language processing) or (language skills) or (language typology) or (lexical development) or lexicology or (listening comprehension) or metalinguistics or morphology or (oral language) or psycholinguistics or (receptive language) or semantics or syntax or (verbal communication) or (verbal development) or vocabulary or sociolinguistics or (second language acquisition) or (second language development) or bilingualism

Concepts About Print (predictor subcategory)

(concepts about print) or (concepts of print) or (concept of word) or directionality or (conventions of print) or (print awareness)

Environmental Print (predictor subcategory)

(environmental print) or (environmental text)

Invented Spelling (predictor subcategory)

(invented spelling) or (developmental spelling) or (emergent spelling)

Listening Comprehension (predictor subcategory)

(listening comprehension) or (aural learning) or (listening comprehension tests) or (verbal comprehension)

Name Writing

(name writing) or (emergent writing skills) or writing or (early writing)

Phonological Awareness (predictor subcategory)

(phonological awareness) or phonemic or (phonemic awareness) or phonetic or (phonological processing) or (phonological sensitivity) or phonology or phoneme or phonological or rhyming or rhymes or blending or segmenting or (sound categorization) or (sound isolation) or (sound awareness) or syllables or vowels

Phonological STM (predictor subcategory)

(phonological short-term memory) or (phonological memory) or (memory for sentences) or (digit span)

RAN (graphological and nongraphological) (predictor subcategory)

(rapid naming)

Verbal IQ (predictor subcategory)

(verbal intelligence) or (verbal ability) or (verbal IQ)

Visual Memory (predictor subcategory)

(visual memory) or (visuospatial memory) or (spatial memory)

Visual Perception (predictor subcategory)

(visual perceptual) or (visual perception) or (word perception) or (form perception) or (binocular vision) or (eye fixation) or (stereoscopic vision) or (visual discrimination) or (visual tracking) or (visual spatial ability) or (visual spatial memory)

2. Intervention Category and Terms

Interventions (ERIC)

(group design) or (control group) or (treatment group) or (experimental design) or intervention or (education experiments) or (early intervention) or pretests or posttests or (program effectiveness) or (educational improvement) or (experimental groups) or (matched groups) or (quasi-experimental design)

Interventions (PsycINFO)

(group design) or (control group) or (treatment group) or (experimental design) or intervention or (early intervention) or (treatment effectiveness evaluation) or (between group

designs) or experimentation or (experimental subjects) or pretesting or (repeated measures) or posttesting or (program evaluation) or (educational program evaluation) or (experimental replication)

3. Age Category and Terms

Age category and terms (original search)

(early childhood education) or (early experience) or infants or (kindergarten children) or (preschool children) or toddlers or (young children) or (infant development)

Age category and terms (revised search)

(early childhood education) or (early experience) or infants or (kindergarten children) or (preschool children) or toddlers or (young children) or (infant development) or (kindergarten students) or (preschool students)

4. Literacy Category and Terms

literacy or (beginning reading) or (content area reading) or (corrective reading) or (critical reading) or (early reading) or (functional reading) or (independent reading) or (oral reading) or (recreational reading) or (remedial reading) or (silent reading) or (story reading) or (reading ability) or (reading achievement) or (reading comprehension) or decoding or (reading diagnosis) or (reading difficulties) or (reading failure) or (reading improvement) or (reading processes) or (reading research) or (reading skills) or (reading strategies) or (reading writing relationship) or writing or composition or (writing ability) or (writing achievement) or (writing attitudes) or (writing contexts) or (writing development) or (writing difficulties) or (writing evaluation) or (writing improvement) or (writing processes) or (writing readiness) or (writing research) or (writing skills) or (writing strategies) or dyslexia or fluency or (inner speech) or subvocal or (orthographic knowledge) or prosody or reading or (reading assessment) or (reading disabilities) or (reading disability) or (reading evaluation) or (reading rate) or (sight method) or (sight vocabulary) or (sight words) or spelling or (word automaticity) or (word learning) or (word recognition) or writing or (writing assessment)

Appendix 1.E: Intervention Subcategory Codes

Subcategory 1: Making Sense of Print

1. Phonological Awareness Training (check all that apply)
   - ❒ Sub-phonemic (syllable, rhyme, onset, rime)
   - ❒ Phonemic (phonemes)
   - ❒ Analysis (deletion, elision, counting)
   - ❒ Synthesis (blending)
   - ❒ With alphabet knowledge training (letter sounds)
   - ❒ With alphabet knowledge (letter names)

2. Alphabet Knowledge Training (check all that apply)
   - ❒ Letter sounds
   - ❒ Letter names
   - ❒ Other:_____

3. Child's Reading Ability (check all that apply)
   - ❒ Knows no letter names/sounds
   - ❒ Knows some letter names/sounds Specify:_____
   - ❒ Non-reader
   - ❒ Reader Specify level:_____

Subcategory 2: Shared Reading

Background

1. Paternal Education
   - ❒ Less than high school
   - ❒ Some high school
   - ❒ High school diploma
   - ❒ GED
   - ❒ Vocational
   - ❒ Some college
   - ❒ College graduate
   - ❒ Other
   - ❒ Unknown

2. Number of Adults in the Home
   - ❒ Number: _____
   - ❒ Unknown

3. Number of Children in the Home
   - ❒ Number:_____
   - ❒ Unknown

4. Parent Reading Ability
   - ❒ Specify:_____
   - ❒ Unknown

Parent/Teacher Training and Support

1. Who is providing book sharing/reading? (Check all that apply)
   - ❒ Parent
   - ❒ Teacher
   - ❒ Computer
   - ❒ Other:_____
   - ❒ Unknown

2. Amount of training provided
   - ❒ Minutes:_____
   - ❒ Other:_____
   - ❒ Unknown

3. Books provided (check all that apply)
   - ❒ No books provided
   - ❒ Given to family all at one time
   - ❒ Given to family as the program proceeded
   - ❒ Given to classroom or school
   - ❒ Lending library program
   - ❒ Other:_____
   - ❒ Unknown

4. Number of books provided
   - ❒ None
   - ❒ Number:_____
   - ❒ Unknown

5. Kinds of books provided (check all that apply)
   - ❒ Storybooks
   - ❒ Informational books
   - ❒ Alphabet books
   - ❒ Other:_____
   - ❒ Unknown

6. Characteristics of Training (check all that apply)
   - ❒ Print focus (guiding children to look at print, asking questions about letters, pointing at words)
   - ❒ Content focus (asking questions about the story, comments about the story, etc.)
   - ❒ Parents/teachers trained to ask questions Specify type:_____
   - ❒ Parents/teachers trained to elicit responses from or actions by the child
   - ❒ Parents/teachers trained how to reply/react to child responses
   - ❒ Parents/teachers trained to direct child's attention to the pictures
   - ❒ Parents/teachers encouraged to read books repeatedly to their child
   - ❒ Parents/teachers trained to elicit retellings of the story
   - ❒ Other:_____
   - ❒ Unknown

7. Who trained the parents (check all that apply)
    - ❒ Teacher
    - ❒ Librarian
    - ❒ Other parents
    - ❒ Researcher
    - ❒ Other:_____
    - ❒ Unknown

8. Training materials (check all that apply)
    - ❒ Manual/Handbook
    - ❒ Video
    - ❒ Demonstration
    - ❒ Guided practice with own children
    - ❒ Other:_____
    - ❒ Unknown

Parent/Child Interaction

1. Interaction Characteristics (check all that apply)
    - ❒ Child could see print being read
    - ❒ Parent draw child's attention to print Specify:_____
    - ❒ Child engaged during the reading (looking at book, pointing, book-related comments, turning pages, etc.)
    - ❒ Child answering parent questions
    - ❒ Parent answering child questions
    - ❒ Other:_____
    - ❒ Unknown

2. Number of times book read per sitting
    - ❒ Number:_____
    - ❒ Unknown

3. Number of books read per sitting
    - ❒ Number:_____
    - ❒ Unknown

4. Number of times parent read to child
    - ❒ Number:_____
    - ❒ Unknown

5. Length of book reading
    - ❒ Minutes:_____
    - ❒ Other: _____
    - ❒ Unknown

Subcategory 3: Parent and Home Programs

1. Intervention Focus (check all that apply)
    - ❒ Oral language only

❒ Oral and written language
❒ General Development
❒ Affective Development
❒ Other:_____
❒ Unknown

2. Family Focus
❒ Family (general) ➔ Child
❒ Specific Parent ➔ Child
❒ Parent and Child
❒ Other:_____
❒ Unknown

3. Intervention Characteristics (check all that apply)
❒ Mother-Child Dyads
❒ Home-based; scripted, highly structured
❒ International
❒ Other:_____
❒ Unknown

4. Materials
❒ None
❒ Books
❒ Toys
❒ Other:_____
❒ Unknown

Subcategory 4: Preschool and Kindergarten Experience

1. Type of Experience (check all that apply)
❒ Promotion/Retention
❒ Head Start
❒ Head Start + Abecedarian
❒ Head Start + Darcee
❒ Head Start + Follow Through
❒ Other Early Childhood:_____
❒ None
❒ Preschool + Head Start
❒ Preschool + Abecedarian
❒ Preschool + Social Services
❒ Preschool + Nutrition
❒ Preschool + Low Ratios
❒ Preschool + In-service professional development
❒ Preschool + Parent Involvement
❒ Preschool + Other:_____
❒ Unknown

2. Years of Experience (check all that apply)
    - ❒ Preschool Specify:_____
    - ❒ Kindergarten Specify:_____
    - ❒ Other:_____
    - ❒ Unknown

3. Program Length
    - ❒ Full Day Number:_____
    - ❒ Half Day: Number:_____
    - ❒ Other:_____
    - ❒ Unknown

4. Support Services Provided (check all that apply)
    - ❒ None
    - ❒ Transition classes/services
    - ❒ Parent Workshops
    - ❒ Family Education
    - ❒ Home Visitation
    - ❒ Other:_____
    - ❒ Unknown

Subcategory 5: Language Enhancement

1. Language Impairment (check all that apply)
    - ❒ Expressive delay
    - ❒ Grammar
    - ❒ Phonology
    - ❒ Receptive/Listening comprehension
    - ❒ Severe
    - ❒ Other:_____
    - ❒ None
    - ❒ Unknown

2. Who delivered instruction (check all that apply)
    - ❒ Parent
    - ❒ Clinician
    - ❒ Teacher
    - ❒ Other:_____
    - ❒ Unknown

3. Media Provided
    - ❒ None
    - ❒ Computer
    - ❒ Television
    - ❒ Unknown

4. Type of Instruction (check all that apply)
    - ❒ Programmed Instruction (e.g., Distar, Hanen Program for Parents, Language for Learning, etc.)
    - ❒ Direct Language Production
    - ❒ Play-focused
    - ❒ Teacher-directed
    - ❒ Child-initiated
    - ❒ Other:_____
    - ❒ Unknown

5. Focus of Instruction (check all that apply)
    - ❒ Consonants
    - ❒ Pragmatics
    - ❒ Semantics
    - ❒ Syntax
    - ❒ Vowel sounds
    - ❒ Words
    - ❒ Other:_____
    - ❒ Unknown

6. Types of strategies (check all that apply)
    - ❒ Expansion
    - ❒ Focused stimulation
    - ❒ Implicit correction
    - ❒ Interactive dialogue
    - ❒ Modeling
    - ❒ Modeling + reinforcement
    - ❒ Operant conditioning
    - ❒ Parallel talk
    - ❒ Recasting
    - ❒ Repetition
    - ❒ Scaffolding
    - ❒ Shared reference
    - ❒ Songs/rhymes
    - ❒ Vocal imitation
    - ❒ Other:_____
    - ❒ Unknown

7. Materials
    - ❒ None
    - ❒ Toys
    - ❒ Books
    - ❒ Other:_____
    - ❒ Unknown

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Chapter 2

IDENTIFICATION OF CHILDREN'S SKILLS AND ABILITIES LINKED TO LATER OUTCOMES IN READING, WRITING, AND SPELLING

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The National Early Literacy Panel

The objective of convening the National Early Literacy Panel (NELP) was to identify interventions and practices that promote positive outcomes in literacy for preschool children. Prior to the onset of formal instruction in kindergarten and beyond, few interventions that directly target the conventional literacy skills (decoding, reading comprehension, spelling, writing) can be found. Not only are such interventions few, but it is unlikely that such interventions would be considered developmentally appropriate for preschool-age children. Additionally, the panel suspected that there would be few studies aimed at enhancing later conventional literacy skills that would follow children for a sufficient length of time to observe such effects. Consequently, the panel determined that the first step in its research synthesis would need to involve the identification of skills that strongly predicted later conventional literacy skills. This determination produced the panel's first research question described in Chapter One: What are the skills and abilities of young children (age birth through five years or kindergarten) that predict later reading, writing, or spelling outcomes?

Although there have been a plethora of theoretical writings, professional opinions, and best-practice documents proposing skills that should be considered the precursors to conventional literacy, to date, there has been little systematic empirical summation of research demonstrating that these early literacy skills predict later conventional literacy.[1] Two recent documents

[1] The National Center for Education Statistics has had an important series of longitudinal investigations under way, the Early Childhood Longitudinal Studies (ECLS), since the late 1990s. These studies have been tracking children's learning and development from kindergarten and birth on to identify growth trajectories in school learning and the relationship of various child and environmental variables to these trajectories. Unfortunately, none of these investigations had directly examined the predictability of later literacy performance on the basis of early childhood variables. Although reports are now emerging that are making this link, these were not available when the NELP work was undertaken. The reports that have emerged from this project so far have not looked at the relationship of individual child performance variables in relationship to later literacy success, but they have examined composites of variables, and these analyses have generally been consistent with the findings reported here (e.g.,

provided consensus or narrative summaries of a portion of the research literature concerning the relationship between early precursor skills and later conventional literacy skills. Snow, Burns, and Griffin (1998), in their report of the National Research Council's panel on preventing reading difficulties in young children, identified weaknesses in oral language, phonological awareness (PA), and alphabet knowledge (AK) as prime targets of intervention to prevent the occurrence of significant reading problems. Similarly, Whitehurst and Lonigan (1998) identified skills in the domains of oral language, print and letter knowledge, and phonological processing as encompassing two aspects (outside-in and inside-out skills) of emergent literacy that are related to later conventional forms of reading and writing. Whereas these two documents provided the beginnings of a structure to understand those skills that may serve as the developmental precursors to reading and writing abilities, neither document was based on a comprehensive summary of the published literature.

As summarized in the description of NELP methods, a list of search terms in nine categories was created (language, cognition, motivation, schooling, home and family, word learning, fluency, reading comprehension, miscellaneous). Systematic electronic searches were conducted for published articles that were indexed by these search terms. These searches yielded 7,313 articles. An iterative process of review of these articles for relevance (i.e., initial screening, abstract review, article review) resulted in the elimination of 7,038 articles. Most articles were eliminated because they did not include usable data (e.g., no correlations reported, qualitative study, theoretical article), did not include relevant variables (e.g., no reading- or writing-related outcome variable), or did not include the age group that was the focus of this analysis (e.g., children of kindergarten age or younger). Of the 275 articles that passed all three tiers of the screening process, 41 were rejected during the coding process because they did not report sufficient information to allow coding of effects. A revised literature search conducted after the panel determined that age terms had prevented the identification of key resources in PsycINFO resulted in a final total of 299 articles. These articles reported the results of studies that involved the measurement of one or more child skills assessed when children were between birth and five years of age or in kindergarten and the measurement of one or more child outcomes on a conventional literacy skill assessed when children were in kindergarten or older.

Included in the panel's discussion of identification of early literacy skills linked to later outcomes in conventional literacy were specification of conditions required for something to be considered an early literacy skill and specification of the domain of conventional literacy skills. In defining an emergent or early literacy skill, the panel required that two conditions be met. First, the skill needed to be present before the conventional literacy skill, and second, the skill needed to be related to or predictive of a conventional literacy skill. These conditions establish two of the three criteria required for causal interpretation: temporal precedence and covariation. Given the correlational nature of the data in the articles included in this meta-analysis, the third condition for causal interpretation (ruling out of alternative explanations for the observed covariation between variables) could not be established. However, as described later (see the Multivariate

composites including measures of alphabet knowledge, phonological awareness, visual-motor skills, and concepts of print have collectively been predictive of later reading achievement), but it would be worthwhile to have a more specific comparative analysis of these meta-analytical results with the longitudinal results of those large data sets. Some of the recent studies to emerge using ECLS data to examine literacy development include Chatterji (2006), Kaplan and Walpole (2005), Son and Meisels (2006), and Denton and West (2002).

Studies section), the panel attempted to provide some clarification of the covariation between identified variables. The panel defined conventional literacy skill in the receptive and expressive domains, which provided a symmetric classification for decoding or encoding print. Receptive skills included the ability to decode print, which included such outcomes as decoding words, decoding nonwords, and decoding fluency and measures of reading comprehension. Expressive skills included spelling and composition. The articles retrieved included outcomes in all of these domains except for composition. Hence, the resulting meta-analysis provides results for two receptive conventional literacy skills (decoding and reading comprehension) and one expressive conventional literacy skill (spelling).

The primary analyses for this part of the research synthesis addressed the identification of preschool and kindergarten predictors of conventional literacy skills. Several sets of secondary analyses were conducted to answer finer-grained questions concerning factors related to the observed strength of the association between these predictors and conventional literacy skills. These secondary analyses included questions concerning the age of assessment for the predictor variable and the age of assessment for the measurement of the conventional literacy outcome variable. Additionally, where possible, the panel's investigation examined the differential strength of association for different facets or means of assessment of the predictor variables.

Primary Analyses

Prior to conducting the meta-analysis, predictor and outcome variables were grouped according to the construct measured by using either the identified standard test of the construct (e.g., standardized tests of decoding, such as the Woodcock Reading Mastery Test) or the description of the measure included in the method section of the articles (e.g., a measure described as requiring children to delete a sound from a word spoken by the examiner was classified as a PA measure). The computation of an effect size (ES) for a predictor variable required that there be a minimum of three studies that contributed a correlation to the analysis. Therefore, variables indexing potential early literacy skills that have not been included in at least three studies are not represented. For these analyses, average correlations that were 0.50 or larger (i.e., the predictor variable explains at least 25 percent of the variance in the outcome variable) were designated as *strong relationships*; average correlations that were between 0.30 and 0.49 (i.e., the predictor variable explains between 9 percent and 25 percent of the variance in the outcome variable) were designated as *moderate relationships*; and average correlations that were below 0.30 (i.e., the predictor variable explains less than 9 percent of the variance in the outcome variable) were designated as *weak relationships*.

The results for the primary analyses include information about the relationship between a predictor variable and a conventional literacy outcome presented in tabular form. For each predictor variable, the information in the table includes the average correlation across all studies, the numbers of studies on which the correlations were based, the numbers of children tested for each correlation, the 95 percent confidence interval (CI) for the average correlation (i.e., –95 percent CI, +95 percent CI), and the Q statistic for the average effect.

No statistic can be measured with absolute accuracy. All measures are imperfect, and the collection of data from samples that are smaller than the total population never provides more

than an estimate of the population results. For that reason, CIs are a useful tool for estimating the accuracy of an estimate. A CI provides a range of possible values within which a population value may lie, with a given confidence. For example, say the average correlation across 10 small studies was 0.50 and the CI for this estimate ranged from 0.40 to 0.60. It is unlikely that the 0.50 correlation obtained for these samples is exactly what would be found if the entire population of all young children were to be tested. But the CI indicates that there is a 95 percent chance that this population value falls somewhere within this CI. CIs are useful for showing whether a statistic is statistically significant (if it does not include zero in the interval, it is statistically significant), and they can be used to compare correlations across variables, with the caveats noted in the methodology chapter. That is, for pairs of variables in which the CI does not overlap, the average correlations are significantly different from each other at the $p < 0.05$ level.

The Q statistic provides a metric of the heterogeneity of observed effects (correlations) across the studies that contributed a value to the average correlation. A large and statistically significant Q statistic indicates that the observed correlations were unlikely to be sampled from the same population of correlations (i.e., the observed correlations have a high degree of heterogeneity). For instance, a significant Q statistic would result if the correlations included in the average were drawn from two populations of children whose average correlations, if computed separately, would be significantly different from each other. One example of such a situation would be if the average correlation included effects from both three- and five-year-old children and the average correlation between a predictor variable measured when children were three years of age and the outcome were significantly higher than the average correlation between a predictor variable measured when children were five years of age and the outcome. Another example would be if multiple measurement methods were used in the studies that contributed to the average correlation when the method of measurement of a predictor variable or an outcome variable influenced the size of the correlation. It is important to note that a significant Q statistic identifies the presence of significant heterogeneity in the distribution of observed effects but does not identify the cause of that heterogeneity.

It is also important to note other factors that can affect the size of the obtained average correlations. Another factor that can affect the size of the correlation is the length of time from the assessment of the predictor to the measurement of the dependent variable. Correlations would presumably be lower, on average, with longer intervals of time in between assessments. The reliability of the measures being used also will affect the size of the correlations, as will restrictions of range resulting from the assessment of groups of children who are drawn from a narrow range of a distribution (such as would occur with the testing of only learning disabled students) or if there were floor or ceiling effects on the measures used to estimate the correlations.

All of these factors can affect the size of the estimated correlations used in these analyses, and this must be acknowledged as a limitation of the results. However, it should also be noted that, for any of these factors to influence the relative ordering of the predictors by size of correlation, these factors would have to be operating differentially for the different predictors. That is, for the relative ordering of the predictors by size of correlation to be affected, there would have to be systematic differences in reliability, restriction of range, or length of time between assessments.

What Skills Measured in the Early Childhood Period or in Kindergarten Were Related to Decoding?

The overall results for the predictive relations between variables measured in kindergarten or earlier and children's decoding skills are presented in Tables 2.1 and 2.1a. Identical information is provided in two formats in these two tables. In Table 2.1, the predictors are listed in order of the strength of correlations with later decoding measures; in Table 2.1a, these same data are reorganized conceptually so that the various groups of predictors (e.g., rapid automatic naming [RAN]; phonology) can be more easily compared.

Table 2.1. Average Correlations for Prediction of Decoding by Variables Measured in Kindergarten or Earlier (organized by size of correlation)

Predictor Variable	Avg. *r*	95% CI		*N* Studies	*N* Children	*Q*
		Lower Bound	Upper Bound			
Decoding nonwords	0.72	0.68	0.75	8	763	132.74**
Spelling	0.60	0.56	0.63	7	1,184	25.13**
Invented spelling	0.58	0.53	0.62	10	778	39.03**
Reading NOS	0.57	0.54	0.60	3	1,739	1.59
Decoding NOS	0.53	0.48	0.57	5	877	59.85**
Decoding words	0.52	0.50	0.55	21	4,121	396.32**
Reading comprehension	0.52	0.47	0.58	5	700	132.14**
AK	0.50	0.48	0.52	52	7,570	719.94**
Readiness	0.50	0.46	0.53	5	1,988	28.20**
Writing or writing name	0.49	0.45	0.53	10	1,650	25.18**
Arithmetic	0.45	0.43	0.48	14	3,929	184.80**
IQ	0.45	0.41	0.48	13	2,015	55.34**
PA	0.40	0.39	0.42	69	8,443	505.84**
RAN letters and digits	0.40	0.36	0.43	12	2,081	40.27**
Concepts about print	0.34	0.31	0.37	12	2,604	75.13**
Oral language	0.33	0.31	0.34	63	9,358	248.58**
RAN objects and colors	0.32	0.29	0.35	16	3,100	25.37*
Phonological NOS	0.31	0.17	0.44	3	174	0.85
Performance IQ	0.30	0.27	0.34	15	2,792	25.18*
Print awareness	0.29	0.22	0.35	6	683	120.14**
Environmental print	0.28	0.22	0.34	6	1,042	60.84**
Phonological STM	0.26	0.24	0.29	33	4,863	163.85**
Visual motor	0.25	0.20	0.30	14	1,316	24.96*
Visual memory	0.22	0.17	0.26	8	1,708	12.11
Visual perception	0.22	0.18	0.26	16	2,551	151.75**

** = $p < 0.05$; **$p < 0.01$.*

Table 2.1a. Average Correlations for Prediction of Decoding by Variables Measured in Kindergarten or Earlier (predictor variables grouped conceptually)

Predictor Variable	Avg. *r*	95% CI		*N* Studies	*N* Children	*Q*
		Lower Bound	Upper Bound			
AK	0.50	0.48	0.52	52	7,570	719.94**
Concepts about print	0.34	0.31	0.37	12	2,604	75.13**
Environmental print	0.28	0.22	0.34	6	1,042	60.84**
Print awareness	0.29	0.22	0.35	6	683	120.14**
Decoding nonwords	0.72	0.68	0.75	8	763	132.74**
Decoding NOS	0.53	0.48	0.57	5	877	59.85**
Decoding words	0.52	0.50	0.55	21	4,121	396.32**
IQ	0.45	0.41	0.48	13	2,015	55.34**
Performance IQ	0.30	0.27	0.34	15	2,792	25.18*
Arithmetic	0.45	0.43	0.48	14	3,929	184.80**
Oral language	0.33	0.31	0.34	63	9,358	248.58**
PA	0.40	0.39	0.42	69	8,443	505.84**
Phonological NOS	0.31	0.17	0.44	3	174	0.85
Phonological STM	0.26	0.24	0.29	33	4,863	163.85**
RAN letters and digits	0.40	0.36	0.43	12	2,081	40.27**
RAN objects and colors	0.32	0.29	0.35	16	3,100	25.37*
Readiness	0.50	0.46	0.53	5	1,988	28.20**
Reading NOS	0.57	0.54	0.60	3	1,739	1.59
Reading comprehension	0.52	0.47	0.58	5	700	132.14**
Spelling	0.60	0.56	0.63	7	1,184	25.13**
Invented spelling	0.58	0.53	0.62	10	778	39.03**
Visual motor	0.25	0.20	0.30	14	1,316	24.96*
Visual memory	0.22	0.17	0.26	8	1,708	12.11
Visual perception	0.22	0.18	0.26	16	2,551	151.75**
Writing or writing name	0.49	0.45	0.53	10	1,650	25.18**

** = $p < 0.05$; ** = $p < 0.01$.*

The predictor variables that were most highly correlated with decoding were other conventional literacy variables.[2] That is, in those studies in which a conventional literacy skill (decoding, reading comprehension, spelling) was measured when children were in kindergarten or earlier, these skills were substantially related to measures of decoding that were obtained when children were in kindergarten or later. All of these effects could be classified as strong relationships.

Several variables typically thought of as representing early literacy development yielded average correlations that could be classified as moderate to strong relationships. Children's AK yielded a strong relationship of 0.50 averaged across 52 studies involving 7,570 children. Measures of children's ability to write or write their names resulted in a moderate relationship of 0.49 averaged across 10 studies involving 1,650 children. Children's PA skills yielded a moderate

[2] The NOS classification (not otherwise specified) is used in cases in which the exact nature of the variable cannot be determined. For instance, *Decoding NOS* in Table 1.1 in Chapter One refers to situations in which the measure of predictor variable could be identified as decoding but whether it involved the decoding of words or nonwords could not be determined.

relationship of 0.40 averaged across 69 studies involving 8,443 children. Measures of oral language yielded a moderate relationship of 0.33 in 63 studies involving 9,358 children. Both types of rapid naming measures also yielded moderate relationships. For rapid naming of letters or digits, an average correlation of 0.40 from 12 studies involving 2,081 children was obtained, and, for rapid naming of objects or colors, an average correlation of 0.32 from 16 studies involving 3,100 children was obtained. Finally, measures of children's concepts about print yielded a moderate relationship of 0.34 in 12 studies involving 2,604 children.

Additional variables that yielded at least moderate relationships included phonological not otherwise specified (NOS) (average $r = 0.31$ in three studies), arithmetic (average $r = 0.45$ in 14 studies), IQ (average $r = 0.45$ in 13 studies), performance or nonverbal IQ (average $r = 0.30$ in 15 studies), and readiness (average $r = 0.50$ in five studies). Measures of readiness contain a mix of early literacy constructs; hence, although a moderate relationship was obtained, it is not clear which component skill or skills contributed to this outcome. Similarly, the phonological NOS variable was not specified clearly enough to determine the nature of the skill being assessed that led to this moderate relationship. Measures of arithmetic knowledge, IQ, and performance IQ seem likely to index general cognitive abilities that are not specific to conventional literacy outcomes. All other variables yielded weak relationships with decoding, including print awareness, environmental print, phonological short-term memory (STM), and all assessment measures involving visual skills.

Examination of the CIs for the correlations (see Table 2.1) suggested that both AK and "writing or writing" name yielded significantly higher correlations with decoding than did other early literacy variables, such as PA, concepts about print, oral language, and both types of rapid naming tasks. Similarly, PA was a stronger predictor of decoding than were concepts about print and oral language. Overall, oral language was the weakest predictor of decoding among the predictor variables yielding at least a moderate relationship. In fact, oral language was not a significantly stronger predictor than many of the predictor variables that yielded only weak relationships. Finally, the Q statistics indicated that, for most predictor variables, there was significant heterogeneity in the observed sample of correlations.

What Skills Measured in the Early Childhood Period or in Kindergarten Were Related to Reading Comprehension?

The overall results for the predictive relationships between variables measured in kindergarten or earlier and children's reading comprehension skills are presented in Tables 2.2 and 2.2a (again, the second table provides the same information organized conceptually by type of variable). As seen in Table 2.2a, fewer studies examined reading comprehension than examined decoding. Two predictor variables yielded correlations that represented strong relationships. Readiness measures yielded an average correlation of 0.59 in three studies involving 348 children, and measures of concepts about print yielded an average correlation of 0.54 in three studies involving 535 children. As noted in the preceding section, the readiness measures contain a mix of skills and do not provide information about which skill or skills contribute to the observed relationships. Additionally, the correlations for these two variables were not significantly higher than the variables that obtained large correlations but were classified as moderate relationships.

Table 2.2. Average Correlations for Prediction of Reading Comprehension by Variables Measured in Kindergarten or Earlier (organized by size of correlation)

Predictor Variable	Avg. *r*	95% CI		*N* Studies	*N* Children	*Q*
		Lower Bound	Upper Bound			
Readiness	0.59	0.51	0.65	3	348	11.76**
Concepts about print	0.54	0.48	0.60	3	535	3.31
AK	0.48	0.45	0.51	17	2,038	28.36*
Print awareness	0.48	0.39	0.56	4	347	8.54*
PA	0.44	0.41	0.48	20	2,461	58.08**
RAN letters and digits	0.43	0.34	0.52	3	333	1.46
RAN objects and colors	0.42	0.38	0.47	6	1,146	6.78
Decoding nonwords	0.41	0.30	0.50	3	282	72.13**
Decoding words	0.40	0.34	0.45	6	1,091	75.82**
Phonological STM	0.39	0.35	0.43	13	1,911	35.25**
Arithmetic	0.35	0.30	0.40	8	1,197	40.64**
Performance IQ	0.34	0.23	0.45	5	253	1.11
Oral language	0.33	0.30	0.36	30	4,015	323.33**
Writing or writing name	0.33	0.26	0.41	4	565	1.11
Visual perception	0.26	0.21	0.31	9	1,438	64.54**
Visual motor	0.22	0.17	0.27	9	1,333	5.86
Concept knowledge	0.20	0.14	0.26	3	873	4.31
Visual memory	0.17	0.10	0.23	5	875	5.06

** = $p < 0.05$; ** = $p < 0.01$.*

Variables reflecting early literacy skills that yielded average correlations that could be classified as moderate relationships appeared to fall into two groupings, one with larger correlations and one with smaller correlations. In the former category, measures of children's AK yielded a moderate relationship of 0.48 averaged across 17 studies involving 2,038 children. Measures of print knowledge yielded a moderate relationship of 0.48 averaged across three studies involving 347 children. Measures of children's PA yielded a moderate relationship of 0.44 averaged across 20 studies involving 2,461 children. Again, both types of rapid naming measures yielded moderate relationships. For measures involving rapid naming of letters or digits, an average correlation of 0.43 was obtained in three studies involving 333 children, and, for measures involving rapid naming of objects or colors, an average correlation of 0.42 was obtained in six studies involving 1,146 children. The second group of early literacy variables with lower correlations included phonological STM, oral language, and "writing **or** writing name." In most cases, the average correlations of these variables were significantly lower than the other variables that yielded moderate to strong relationships with reading comprehension. Measures of children's phonological STM yielded a correlation of 0.39 averaged across 13 studies involving 1,911 children. Measures of oral language produced an average correlation of 0.33 in 30 studies involving 4,015 children. Measures of "writing or writing name" had an average correlation of 0.33 across four studies involving 565 children.

Table 2.2a. Average Correlations for Prediction of Reading Comprehension by Variables Measured in Kindergarten or Earlier (predictor variables grouped conceptually)

Predictor Variable	Avg. *r*	95% CI		*N* Studies	*N* Children	*Q*
		Lower Bound	Upper Bound			
AK	0.48	0.45	0.51	17	2,038	28.36*
Concepts about print	0.54	0.48	0.60	3	535	3.31
Print awareness	0.48	0.39	0.56	4	347	8.54*
Decoding nonwords	0.41	0.30	0.50	3	282	72.13**
Decoding words	0.40	0.34	0.45	6	1,091	75.82**
Arithmetic	0.35	0.30	0.40	8	1,197	40.64**
Performance IQ	0.34	0.23	0.45	5	253	1.11
Concept knowledge	0.20	0.14	0.26	3	873	4.31
Oral language	0.33	0.30	0.36	30	4,015	323.33**
PA	0.44	0.41	0.48	20	2,461	58.08**
Phonological STM	0.39	0.35	0.43	13	1,911	35.25**
RAN letters and digits	0.43	0.34	0.52	3	333	1.46
RAN objects and colors	0.42	0.38	0.47	6	1,146	6.78
Readiness	0.59	0.51	0.65	3	348	11.76**
Writing or writing name	0.33	0.26	0.41	4	565	1.11
Visual perception	0.26	0.21	0.31	9	1,438	64.54**
Visual motor	0.22	0.17	0.27	9	1,333	5.86
Visual memory	0.17	0.10	0.23	5	875	5.06

** = $p < 0.05$; ** = $p < 0.01$.*

Additional variables that yielded at least moderate relationships with reading comprehension included measures of decoding nonwords (average $r = 0.41$ in three studies), measures of decoding words (average $r = 0.40$ in six studies), measures of arithmetic (average $r = 0.35$ in eight studies), and measures of performance IQ (average $r = 0.34$ in five studies). As with the results for decoding, correlations between measures of conventional literacy skills represent the continuity of reading skills. Measures of arithmetic knowledge and performance IQ are most likely an index of general cognitive abilities that are not specific to conventional literacy outcomes. All other variables yielded weak relationships with reading comprehension, including measures of general concept knowledge and all assessment measures involving visual skills.

Similar to results for decoding outcomes, measures of global oral language skills were among the weakest predictors of reading comprehension. Examination of the CIs indicated that oral language was a significantly weaker predictor of reading comprehension than were measures of concepts about print, AK, PA, and the rapid naming tasks. Again, the *Q* statistics indicated that, for predictor variables with more than a handful of studies, there was significant heterogeneity in the observed sample of correlations.

Although the panel searched widely for studies that had measured any early developing skills or abilities and then correlated these with any conventional literacy measures administered later on, most of the studies were conducted within a relatively brief window of development. Although

there were many studies that examined the relationship of skills measured at the beginning of kindergarten with those measured at the end of kindergarten, there were progressively fewer with outcomes measured when the children were older. This is not surprising, but it means that what is known about the relationship of these predictor variables with reading comprehension is limited to the very constrained conceptualizations of reading comprehension that can be measured with young children—levels of comprehension at which decoding is most likely to be implicated statistically.

What Skills Measured in the Early Childhood Period or in Kindergarten Were Related to Spelling?

The overall results for the predictive relations between variables measured in kindergarten or earlier and children's spelling skills are presented in Tables 2.3 and 2.3a (Table 2.3 is organized by size of correlation, and Table 2.3a presents the same information organized conceptually by type of variable). Among the predictor variables that were most highly correlated with spelling outcomes were early measures of spelling, including invented spelling, and decoding. Two variables reflecting measures of spelling and two variables reflecting measures of decoding yielded strong relationships with children's spelling skills measured in kindergarten and later. Measures of children's AK also yielded a strong relationship with spelling outcomes of 0.54 averaged across 18 studies involving 2,619 children. Additionally, measures of IQ and measures of arithmetic ability yielded strong relationships with spelling outcomes. As noted previously, measures of IQ and arithmetic knowledge most likely index general cognitive abilities that are not specific to conventional literacy outcomes.

Moderate relationships with spelling outcomes were obtained for several variables. Variables reflecting children's visual perceptual abilities yielded a correlation of 0.44 averaged across five studies involving 548 children. Measures of concepts about print had an average correlation of 0.43 in four studies involving 534 children. Children's PA skills had an average correlation of 0.40 in 21 studies involving 2,522 children. Measures of global oral language skills yielded a moderate relationship of 0.36 averaged across 18 studies involving 2,087 children. Other variables that had average correlations classified as a moderate relationship with spelling included "writing **or** writing name" (average $r = 0.36$ in three studies), phonological STM (average $r = 0.31$ in 10 studies), and rapid naming of objects or colors (average $r = 0.31$ in six studies). Measures of performance IQ, visual motor skills, and environmental print yielded weak relationships with spelling outcomes.

Examination of the CIs indicated that AK was the strongest literacy-specific nonconventional literacy predictor of spelling outcomes. With the exception of visual perceptual skills, all other variables that yielded a moderate relationship with spelling outcomes (e.g., concepts about print, PA, oral language) had significantly smaller average correlations with spelling than did AK. Among variables within the moderate relationship category, there were no significant differences in the strength of the correlations. The Q statistics again indicated that, for predictor variables with more than a handful of studies, there was significant heterogeneity in the observed sample of correlations.

Table 2.3. Average Correlations for Prediction of Spelling by Variables Measured in Kindergarten or Earlier (organized by size of correlation)

Predictor Variable	Avg. *r*	95% CI		*N* Studies	*N* Children	*Q*
		Lower Bound	Upper Bound			
Spelling	0.78	0.74	0.82	4	398	85.99**
Invented spelling	0.69	0.63	0.74	3	354	14.70**
AK	0.54	0.51	0.57	18	2,619	62.73**
Decoding nonwords	0.54	0.45	0.63	3	246	7.43*
Decoding words	0.54	0.50	0.58	6	1,112	68.70**
IQ	0.54	0.41	0.65	3	142	4.11
Arithmetic	0.50	0.39	0.60	3	203	6.45*
Visual perception	0.44	0.37	0.51	5	548	5.74
Concepts about print	0.43	0.35	0.49	4	534	11.32**
PA	0.40	0.37	0.44	21	2,522	70.05**
Oral language	0.36	0.32	0.40	18	2,087	13.73
Writing or writing name	0.36	0.27	0.44	3	397	1.56
Phonological STM	0.31	0.27	0.36	10	1,520	10.93
RAN objects and colors	0.31	0.25	0.36	6	1,132	4.14
Performance IQ	0.29	0.20	0.37	6	446	5.02
Visual motor	0.27	0.18	0.36	3	387	3.09
Environmental print	0.25	0.18	0.31	4	818	7.51

** = $p < 0.05$; ** = $p < 0.01$.*

Examination of Multivariate Studies

These results indicate that a number of early literacy skills measured in kindergarten or earlier have strong to moderate relationships with conventional literacy outcomes. It is important to note, however, that all of the results presented in Tables 2.1, 2.2, and 2.3 represent zero-order correlations. It is possible that some of the observed relationships between early literacy variables and conventional literacy outcomes represent overlap among the early literacy variables. That is, variables may share predictive variance with each other; however, zero-order correlations do not allow this possibility to be investigated. Greater confidence that the observed zero-order correlation was attributable to the nominal construct of a predictor variable would be obtained if that variable were still significantly related to the outcome variable after other important variables were controlled. For example, does the correlation between PA and decoding still hold even when controlling for AK and oral language?

To partially address this question, the panel examined the multivariate studies that were retrieved as part of the search for the first research question. Multivariate studies typically use multiple regression or similar analytic techniques to examine the predictive utility (i.e., semipartial correlation) of a variable in the context of other variables. Not all variables were examined in these multivariate studies, and, when they were, the control variables used encompassed a broad range of constructs (e.g., age, socioeconomic status, IQ, oral language, AK). In some cases, multiple variables were controlled at the same time in an analysis. In other cases, only a single

variable was controlled. There are no meta-analytical procedures for combining the results of multivariate analyses across studies; consequently, the results of the multivariate studies cannot be used to determine whether a variable would continue to be significantly related to one of the conventional literacy outcome variables under all potential conditions. However, multiple instances of robust prediction of a variable when different control variables are used either alone or in combination allow greater confidence in the results obtained from the analyses of the zero-order correlations.

Table 2.3a. Average Correlations for Prediction of Spelling by Variables Measured in Kindergarten or Earlier (predictor variables grouped conceptually)

Predictor Variable	Avg. *r*	95% CI		*N* Studies	*N* Children	*Q*
		Lower Bound	Upper Bound			
AK	0.54	0.51	0.57	18	2,619	62.73**
Concepts about print	0.43	0.35	0.49	4	534	11.32**
Environmental print	0.25	0.18	0.31	4	818	7.51
Decoding nonwords	0.54	0.45	0.63	3	246	7.43*
Decoding words	0.54	0.50	0.58	6	1,112	68.70**
IQ	0.54	0.41	0.65	3	142	4.11
Performance IQ	0.29	0.20	0.37	6	446	5.02
Arithmetic	0.50	0.39	0.60	3	203	6.45*
Oral language	0.36	0.32	0.40	18	2,087	13.73
PA	0.40	0.37	0.44	21	2,522	70.05**
Phonological STM	0.31	0.27	0.36	10	1,520	10.93
RAN objects and colors	0.31	0.25	0.36	6	1,132	4.14
Spelling	0.78	0.74	0.82	4	398	85.99**
Invented spelling	0.69	0.63	0.74	3	354	14.70**
Visual motor	0.27	0.18	0.36	3	387	3.09
Visual perception	0.44	0.37	0.51	5	548	5.74
Writing or writing name	0.36	0.27	0.44	3	397	1.56

** = $p < 0.05$; ** = $p < 0.01$.*

In general, the multivariate studies support the importance of the predictors identified as having moderate to strong relationships with conventional literacy outcomes in the meta-analyses. Multivariate studies examining the relationship between AK and decoding, reading comprehension, and spelling revealed that AK was a significant predictor when controlling for age, socioeconomic status, oral language, PA, and IQ. In multivariate studies, PA continued to be a significant predictor of decoding, reading comprehension, and spelling even when controlling for age, socioeconomic status, AK, oral language, IQ, and prior decoding ability. Measures of concepts about print were significant predictors of decoding and spelling when age and language were controlled but not when PA and AK were controlled in one study. Multivariate analyses of the predictive relations between phonological STM and decoding, reading comprehension, and spelling revealed that it continued to be a significant predictor when age, PA, oral language, socioeconomic status, and IQ were controlled. Oral language continued to be a significant predictor of decoding, reading comprehension, and spelling in some studies

when age, socioeconomic status, and IQ were controlled. In other studies, oral language was not a significant predictor of decoding when AK and PA were controlled. A few multivariate studies examined measures of "writing or writing name." Even when controlling for AK, oral language, and IQ, measures of "writing or writing name" were significant predictors of decoding and comprehension. Multivariate studies showed that measures of rapid naming of either letters and digits or objects and colors were significant predictors of decoding, reading comprehension, and spelling after controlling for age, IQ, oral language, AK, PA, and phonological STM. Finally, the review of the multivariate studies did not support an independent predictive relationship for visual perceptual skills for spelling once socioeconomic status, IQ, AK, and oral language were controlled.

Summary of Primary Analyses

When measured in kindergarten or earlier, several variables are moderate to strong predictors of later outcomes in conventional literacy. A summary of the results of the three meta-analyses and a summary of findings from multivariate studies are shown in Table 2.4 for literacy-related variables with at least a moderate zero-order relationship with at least one conventional literacy outcome. Strength of relationship is based on the ratings discussed earlier (0–0.29 = small; 0.30–0.49 = moderate; ≥ 0.50 = strong). Ten variables meet this criterion. Of these 10 variables, six variables (AK, PA, rapid naming of letters and digits, rapid naming of objects and colors, "writing or writing name," phonological STM) were consistently related to later conventional literacy outcomes, and these six variables continued to be predictive when other variables were controlled in multivariate analyses. Most of these findings are the result of a relatively large number of studies that included a large number of children. Consequently, these relationships between these variables and later conventional literacy outcomes not only are sizable, but they are likely to be highly reliable and stable.

Table 2.4. Summary of Meta-Analytic and Multivariate Results for Literacy-Related Predictor Variables with Moderate to Strong Relationships with Conventional Literacy Outcomes

Predictor Variable	Decoding	Reading Comprehension	Spelling	Multivariate Significance
AK	++	+	++	Yes
PA	+	+	+	Yes
Concepts about print	+	++	+	Sometimes
RAN letters and digits	+	+	NA	Yes
RAN objects and colors	+	+	+	Yes
Writing or writing name	+	+	+	Yes
Oral language	+	+	+	Sometimes
Phonological STM	—	+	+	Yes
Visual perception	—	—	+	No
Print awareness	—	+	NA	NA

Note: ++ = strong relationship based on zero-order correlations; + = moderate relationship based on zero-order correlations; — = weak relationship based on zero-order correlations; NA = no relevant data available for analysis.

These results also identify variables that have only a weak relationship with later conventional literacy or for which there is no current evidence of a relationship. In general, variables reflecting measures of visual skills (i.e., visual motor, visual memory) are only weakly related to later reading and writing. Additionally, variables reflecting measures of environmental print (e.g., the ability to decode or read common signs and logos) are only weakly related to later reading and writing. Some variables that have been proposed as reflecting precursor literacy skills did not appear in any of the analyses (e.g., emergent reading). As noted previously, only those variables for which at least three studies included a reported correlation between the skill measured in kindergarten or earlier and a conventional literacy outcome could be included in the analyses. It may be that these variables have not been related to later conventional literacy outcomes or that there were fewer than three studies available in the published literature.

A final point to take away from these results concerns the remarkable degree of stability of conventional literacy skills. Generally, these skills were the strongest or among the strongest predictors of decoding, reading comprehension, and spelling. Moreover, the sizes of the relationships were in the strong range, accounting for 27 to 61 percent of the variance in later measures of decoding and spelling. These findings highlight the fact that the origins of well-developed conventional literacy skills are found very early in children's educational experience, and these findings are consistent with studies (Francis et al., 1996; Juel, 1988; Torgesen & Burgess, 1998) showing that the consequences of falling seriously behind in the development of conventional literacy skills are likely to be long-lasting in the absence of substantial remedial efforts.

Secondary Analyses

The results reported in the primary analyses address the primary question that the panel posed. That is, they identified the skills and abilities measured when children are in kindergarten or earlier that have moderate to strong predictive relations to later outcomes in conventional literacy skills. However, these findings represented a broad age range of when the predictor skills were assessed (i.e., birth through kindergarten) and when the conventional literacy outcome was assessed (i.e., kindergarten and later) and variable lengths of time between predictors and outcome assessments. Additionally, several of the predictor variables were grouped into very broad categories. In some cases, there are compelling theoretical reasons for stronger relations between some components of these skills and conventional literacy outcomes than others. Therefore, secondary analyses were conducted to address questions related to age of assessment for both the predictor variable (i.e., preschool versus kindergarten) and the outcome variable (i.e., kindergarten versus first or second grade). Secondary analyses also afforded a finer-grained analysis of some of the predictor variables (i.e., oral language, PA).

Do Variables Have Stronger or Weaker Predictive Relations Depending on When They Were Measured (Preschool Versus Kindergarten)?

As noted in the preceding section, the relationships between the predictor variables and conventional literacy outcomes were estimated using a potentially broad age range of children. In fact, very few studies included in the analyses investigated very young children. Most of

the children in the samples of the studies used in the analyses were four years of age or older. Nonetheless, developmental or experiential factors might differentially influence the size of the predictive relationships for variables measured at the preschool age and those for children already in kindergarten. For instance, many children who are in kindergarten are already exposed to formal reading instruction. It is possible that this instructional exposure both develops one of the predictor skills and is responsible for the predictive relationship. For instance, a child exposed to high-quality reading instruction may develop strong PA and strong decoding skills; however, in the absence of this instruction, neither PA nor decoding would be related.

To examine the impact of the age at which a skill was assessed on the predictive relationship with later conventional literacy skills, studies were divided into two groups. One group included studies in which all of the children were not in kindergarten (i.e., children were preschool age) and one group included studies in which all of the children were in kindergarten. Studies with blended samples were excluded from the analyses (i.e., studies that included both preschool- and kindergarten-age children in the same analyses were not used in these analyses). Again, these meta-analyses require that a minimum of three studies be available to estimate an ES. Consequently, any predictor-outcome combination that was not represented by at least three preschool studies and at least three kindergarten studies could not be included in these analyses.

Results of the analyses for the decoding outcome are shown in Table 2.5. As can be seen in the table, there were few differences in the predictive relationship between a variable and decoding dependent on the age of assessment. In most cases, there was substantial overlap of the CIs for the separate ES estimates, indicating that the predictive relationship was similar regardless of when the predictor variable was measured. Three variables did differ significantly or marginally depending on when they were assessed. Both phonological STM and visual perception skills had significantly stronger relationships with decoding outcomes when they were measured in preschool than when they were measured in kindergarten. In contrast, the predictive relationship between "writing or writing name" and decoding was marginally higher when measured in kindergarten than when measured in preschool.

Results of the analyses for the reading comprehension outcome are shown in Table 2.6. Both AK and oral language were equally predictive of reading comprehension regardless of measurement in preschool versus kindergarten. PA was a marginally better predictor of reading comprehension when it was measured in kindergarten than when it was measured in preschool (although both correlations reflect moderate relationships). In contrast, both phonological STM and visual perception skills were significantly better predictors of reading comprehension when they were measured in preschool than when they were measured in kindergarten. For phonological STM, the preschool correlation represented a strong relationship.

Results of the analyses for the spelling outcome are shown in Table 2.7. Only the predictive relation for AK significantly varied as a function of preschool or kindergarten measurement points. When measured in kindergarten, AK had a strong relationship with spelling, but when measured in preschool, it had a moderate relationship with spelling.

Table 2.5. Average Correlations for Prediction of Decoding by Variables Measured in Preschool versus Kindergarten

Predictor Variable	Studies Including Only Preschool Children					Studies Including Only Kindergarten Children					Comparison
	Avg. *r*	95% CI		*N* Studies	*N* Children	Avg. *r*	95% CI		*N* Studies	*N* Children	
		Lower Bound	Upper Bound				Lower Bound	Upper Bound			
AK	0.49	0.44	0.53	7	990	0.50	0.48	0.52	46	6,865	P = K
IQ	0.44	0.33	0.54	3	233	0.45	0.41	0.48	9	1,768	P = K
PA	0.43	0.37	0.49	11	820	0.40	0.38	0.42	60	7,805	P = K
Phonological STM	0.42	0.35	0.48	8	663	0.24	0.21	0.27	26	4,270	P > K
Writing or writing name	0.41	0.33	0.48	3	509	0.52	0.48	0.57	7	1,141	K ≥ P
Visual perception	0.39	0.30	0.47	3	384	0.19	0.15	0.23	13	2,167	P > K
Concepts about print	0.34	0.25	0.43	4	393	0.34	0.30	0.38	8	2,211	P = K
Oral language	0.32	0.28	0.37	15	1,377	0.33	0.31	0.35	50	8,131	P = K
Performance IQ	0.32	0.19	0.43	5	228	0.30	0.26	0.33	11	2,635	P = K
Visual motor	0.28	0.19	0.36	4	435	0.24	0.18	0.30	10	881	P = K

Note: P = preschool correlation; K = kindergarten correlation.

Table 2.6. Average Correlations for Prediction of Reading Comprehension by Variables Measured in Preschool Versus Kindergarten

Predictor Variable	Studies Including Only Preschool Children					Studies Including Only Kindergarten Children					Comparison
	Avg. *r*	95% CI		*N* Studies	*N* Children	Avg. *r*	95% CI		*N* Studies	*N* Children	
		Lower Bound	Upper Bound				Lower Bound	Upper Bound			
Phonological STM	0.51	0.44	0.57	4	479	0.34	0.30	0.39	9	1,433	P > K
AK	0.45	0.38	0.51	4	583	0.48	0.44	0.52	14	1,638	P = K
Visual perception	0.41	0.32	0.49	3	378	0.21	0.15	0.27	6	1,060	P > K
Oral language	0.40	0.33	0.47	7	575	0.32	0.29	0.35	23	3,441	P = K
PA	0.36	0.27	0.43	5	464	0.46	0.43	0.50	15	1,998	K ≥ P

Note: P = preschool correlation; K = kindergarten correlation.

Table 2.7. Average Correlations for Prediction of Spelling by Variables Measured in Preschool Versus Kindergarten

Predictor Variable	Studies Including Only Preschool Children					Studies Including Only Kindergarten Children					Comparison
	Avg. *r*	95% CI		*N* Studies	*N* Children	Avg. *r*	95% CI		*N* Studies	*N* Children	
		Lower Bound	Upper Bound				Lower Bound	Upper Bound			
AK	0.43	0.37	0.49	3	668	0.55	0.52	0.58	16	2,288	K > P
Oral language	0.36	0.29	0.43	6	621	0.36	0.31	0.40	12	1,466	P = K
PA	0.38	0.31	0.45	6	612	0.42	0.38	0.46	17	2,092	P = K
Phonological STM	0.40	0.32	0.47	4	472	0.27	0.22	0.33	6	1,048	P = K

Note: P = preschool correlation; K = kindergarten correlation.

In sum, there appears to be little difference in the size of the predictive relationship for variables measured in preschool and those measured in kindergarten. Of the comparisons that could be examined, 75 percent yielded results that did not differ significantly between the preschool assessment and the kindergarten assessment. Of the four significant differences, only the AK–spelling effect represented one of the consistently strong predictor variables (see Table 2.4). Moreover, when differences were significant, they tended to favor the preschool assessment, and it was typically the case that correlations for both preschool and kindergarten assessments remained in the moderate relationship range.

Do Variables Have Stronger or Weaker Predictive Relations Depending on When the Conventional Literacy Outcome Variable Was Measured (Kindergarten Versus First or Second Grade)?

Similar to the question of differential effects as a function of the age at which the predictor variable was assessed, it is possible that the age at which the conventional literacy outcome was assessed affected the strength of the predictive relationship between a skill measured in kindergarten or earlier and an outcome in the conventional literacy domain. For instance, it is likely that assessments that occur closer in time will be more highly correlated than assessments with more time elapsed between them. The primary analyses included outcomes measured from kindergarten through later grades. Although most studies included outcomes measured early in the elementary-school period, some studies included much longer-term outcomes.

To examine the impact of the age at which a conventional literacy outcome was assessed on the predictive relationship with skills measured when children were in kindergarten or younger, studies were divided into two groups. One group included studies in which all of the children were in kindergarten at the time of the outcome assessment, and one group included studies in which all of the children were in first or second grade at the time of the outcome assessment. Studies with blended samples were excluded from the analyses (i.e., studies that included outcomes measured and reported for a combined kindergarten–first- or second-grade sample were not used in these analyses). Again, these meta-analyses require that a minimum of three studies be available to estimate an ES. Consequently, any predictor-outcome combination that

was not represented by at least three kindergarten studies and at least a total of three first-grade or second-grade studies could not be included in these analyses.

Comparisons of the predictive relationships between skills measured in kindergarten or earlier and decoding measured in either kindergarten or first or second grade are shown in Table 2.8. There were a number of significant differences that generally showed that the kindergarten correlation was higher than the first-grade–second-grade correlation (i.e., AK, arithmetic, concepts about print, decoding words, decoding nonwords, visual perception skills). Two correlations (phonological STM and rapid naming of letters or digits) were higher when decoding was measured in first or second grade than when it was measured in kindergarten. With the exceptions of the correlation between visual perception skills and decoding measured in first or second grade and the correlation between phonological STM and decoding measured in kindergarten, all correlations were in the strong to moderate relationship range regardless of the age of outcome assessment.

For reading comprehension, only a sufficient number of studies measured the outcome in kindergarten for the oral language variable. This comparison indicated that oral language was a significantly stronger predictor when reading comprehension was measured in first or second grade than when it was measured in kindergarten, most likely because of the difficulty of obtaining a valid assessment of reading comprehension in kindergarten. Results for spelling measured in kindergarten versus first or second grade are shown in Table 2.9. Only the correlation between AK and spelling varied as a function of when spelling was assessed. AK had a strong relationship with spelling measured in kindergarten, whereas it had a moderate relationship with spelling measured in first or second grade.

In contrast to results comparing age of assessment for the predictor variable, age of assessment of the conventional literacy outcome variable had a significant influence on the size of the predictive relationship. In these comparisons, 50 percent of the correlations differed significantly depending on when the outcome variable was measured. In all but two cases, the correlation was stronger when the outcome variable was assessed in kindergarten. The simplest explanation for this finding is proximity of assessment. That is, two assessments occurring closer in time are likely to be more highly correlated than two assessments separated by years. Between kindergarten and first and second grades, children are exposed to a significant amount of instruction in reading, which varies by school. The greater the amount of time between an initial assessment and the measurement of the outcome, the more that instructional intensity and quality can affect children's scores. Regardless, as was the case for the assessment of the predictor variable, the size of the correlations when conventional literacy skills were measured either in kindergarten or in first or second grade reflected moderate to strong relationships.

Do Variations in the Aspect of Oral Language Measured Make a Difference in the Strength of the Predictive Relationship (e.g., vocabulary versus grammar)?

Results from the primary analyses revealed a moderate relationship between oral language skills and conventional literacy outcomes. Although the average correlation was in the moderate range, it was among the weakest predictors in that range (average $r = 0.33$ to 0.36). Additionally, the predictive relationship of oral language did not consistently hold up when other predictor

variables were controlled in multivariate analyses. Whereas this finding was not entirely surprising for decoding and spelling, it was somewhat unexpected that the predictive relationship between oral language and reading comprehension was at the low end of the moderate range (see, e.g., Sénéchal & LeFevre, 2002; Storch & Whitehurst, 2002; Whitehurst & Lonigan, 1998). In the primary analyses, oral language was a global variable representing measures of different components of oral language skill (e.g., vocabulary, listening comprehension, syntax). It is possible that different aspects of oral language have weaker or stronger relationships with different aspects of conventional literacy.

Table 2.8. Average Correlations for Prediction of Decoding Measured in Kindergarten Versus First or Second Grade

Predictor Variable	Decoding Measured in Kindergarten					Decoding Measured in First or Second Grade					Comparison
	Avg. *r*	95% CI		*N* Studies	*N* Children	Avg. *r*	95% CI		*N* Studies	*N* Children	
		Lower Bound	Upper Bound				Lower Bound	Upper Bound			
AK	0.58	0.56	0.61	24	3,142	0.44	0.42	0.47	30	4,374	K > G1/2
Arithmetic	0.54	0.51	0.57	6	2,328	0.39	0.36	0.42	8	2,824	K > G1/2
Concepts about print	0.53	0.43	0.62	3	230	0.33	0.29	0.36	8	2,129	K > G1/2
Decoding nonwords	0.80	0.77	0.83	5	481	0.56	0.47	0.64	3	282	K > G1/2
Decoding words	0.69	0.66	0.71	10	1,620	0.50	0.46	0.53	10	1,945	K > G1/2
Invented spelling	0.49	0.41	0.57	5	351	0.63	0.57	0.69	5	427	K = G1/2
Oral language	0.32	0.29	0.35	26	3,985	0.33	0.30	0.35	41	5,534	K = G1/2
Performance IQ	0.32	0.27	0.36	6	1,365	0.28	0.23	0.32	10	1,603	K = G1/2
PA	0.42	0.40	0.45	34	3,618	0.42	0.40	0.44	38	5,206	K = G1/2
Phonological STM	0.22	0.18	0.27	12	1,633	0.31	0.28	0.34	21	3,278	K < G1/2
RAN letters and digits	0.36	0.31	0.41	6	1,251	0.52	0.46	0.56	7	892	K < G1/2
RAN objects and colors	0.28	0.20	0.35	5	578	0.33	0.29	0.36	10	2,305	K = G1/2
Visual perception	0.34	0.25	0.43	4	421	0.14	0.09	0.19	9	1,807	K > G1/2

Note: K = correlation with kindergarten outcome; G1/2 = correlation with first- or second-grade outcome.

Table 2.9. Average Correlations for Prediction of Spelling Measured in Kindergarten Versus First or Second Grade

Predictor Variable	Spelling Measured in Kindergarten					Spelling Measured in First or Second Grade					Comparison
	Avg. *r*	95% CI		*N* Studies	*N* Children	Avg. *r*	95% CI		*N* Studies	*N* Children	
		Lower Bound	Upper Bound				Lower Bound	Upper Bound			
AK	0.60	0.57	0.64	10	1,361	0.49	0.45	0.53	10	1,503	K > G1/2
Oral language	0.37	0.31	0.42	7	1,142	0.35	0.30	0.40	12	1,073	K = G1/2
PA	0.43	0.38	0.47	10	1,305	0.41	0.37	0.46	11	1,351	K = G1/2
Phonological STM	0.28	0.22	0.34	4	902	0.37	0.31	0.44	6	714	K = G1/2
RAN objects and colors	0.29	0.22	0.36	3	738	0.34	0.25	0.42	3	394	K = G1/2

Note: K = correlation with kindergarten outcome; G1/2 = correlation with first- or second-grade outcome.

To assess the possibility that different aspects of oral language are more or less related to outcomes in conventional literacy, all of the oral language measures were coded into subcategories reflecting the content of the assessment measure used. How these subcategories related to decoding and reading comprehension was examined. Spelling was not included in these analyses because of the limited number of studies available (i.e., 18 studies for spelling versus 63 for decoding and 30 for reading comprehension). The results of these analyses are shown in Table 2.10. As is clear from the table, some aspects of oral language had substantial correlations with decoding and reading comprehension. Composite measures that assess multiple aspects of oral language, such as vocabulary, syntax, and listening comprehension, in the same test had correlations in the strong relationship range for both decoding and reading comprehension. The overall language composite measures (e.g., such tests as the *Preschool Language Scale* [Zimmerman, Steiner, & Pond, 2002] or the *Clinical Evaluation of Language Fundamentals: Preschool* [Wiig, Semel, & Secord, 1992]) accounted for almost 50 percent of the variance in reading comprehension, on average. However, it is not clear whether the strength of this relationship reflects the constructs assessed by the measure or the increased reliability of a composite measure of substantial length.

Notably, measures of vocabulary had relatively weak relationships with both decoding and reading comprehension, falling either into the low end of the moderate range or into the weak range. Measures of more complex oral language skills, such as grammar, definitional vocabulary, and listening comprehension, had stronger relationships with both decoding and reading comprehension, falling either into the mid to high moderate range or into the strong range. For reading comprehension, measures of grammar, definitional vocabulary, and listening comprehension were generally significantly stronger predictors than were measures of vocabulary.

Table 2.10. Average Correlations for Prediction of Decoding and Reading Comprehension by Subcategories of Oral Language Measures

Oral Language Measure	Decoding			Reading Comprehension			Comparison
	Avg. *r*	95% CI		Avg. *r*	95% CI		
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Overall language comprehension	0.58	0.52	0.63	0.70	0.66	0.74	D < RC
Receptive language comprehension	0.52	0.46	0.58	0.63	0.58	0.68	D = RC
Expressive language comprehension	0.48	0.43	0.53	0.59	0.54	0.64	D < RC
Grammar	0.47	0.43	0.50	0.64	0.59	0.68	D < RC
Definitional vocabulary	0.38	0.30	0.46	0.45	0.36	0.53	D = RC
Verbal knowledge	0.36	0.31	0.41	0.45	0.39	0.51	D = RC
Verbal IQ	0.35	0.31	0.39	0.35	0.25	0.45	D = RC
Receptive vocabulary	0.34	0.31	0.37	0.25	0.19	0.31	D = RC
Listening comprehension	0.33	0.30	0.36	0.43	0.38	0.48	D < RC
Vocabulary NOS	0.33	0.28	0.38	0.31	0.26	0.36	D = RC
Expressive vocabulary	0.24	0.16	0.31	0.34	0.27	0.40	D = RC
Language NOS	0.20	0.13	0.26	0.31	0.26	0.37	D = RC

Note: D = decoding; RC = reading comprehension.

Such results are potentially instructive about the focus of early childhood education. They suggest that a focus on building vocabulary alone is unlikely to be sufficient for improving outcomes not only in literacy but also in oral language itself. Although, these results should not be taken to imply that well-developed vocabularies are *unimportant* for literacy. The results suggest that well-developed vocabularies are *insufficient* for literacy. More complex oral language skills are dependent on vocabulary. For instance, a child with strong grammatical knowledge but limited vocabulary would have a difficult time understanding a text or writing a meaningful narrative. Vocabulary provides the foundation for grammatical knowledge, definitional vocabulary, and listening comprehension.

Do Variations in the Aspect of Phonological Awareness Measured Make a Difference in the Strength of the Predictive Relationship (e.g., level of linguistic complexity, type of task used)?

Perhaps no area in early literacy has generated as much theoretical debate and empirical inquiry as has the topic of PA. Developing PA is often seen as a necessary condition for acquiring decoding skills in alphabetic languages. Deficits in PA in older children are considered one of the primary causes of developmental dyslexia (Stanovich, 1988; Stanovich & Siegel, 1994). Much of the debate

in this area has focused on the level of PA required to develop decoding skills and the ways in which PA can be demonstrated. For instance, some have argued that only phonemic awareness is related to reading and that only measures that involve manipulation of speech sounds reflect this skill because these measures require reflection on abstract representations. Generally, tasks that require manipulation of phonemes are too difficult for young children, and tasks requiring manipulation rather than detection of speech sounds are often also too difficult for young children. Consequently, by this definition of PA, young children cannot demonstrate reading-related PA.

The primary analyses addressed the relationship between measures of the global construct of PA, measured in different ways at different levels of abstraction. PA is often seen as developing on a continuum, starting with sensitivity to large and concrete units of sounds (i.e., words, syllables) and progressing to sensitivity to small and abstract units of sounds (i.e., phonemes; see Lonigan, 2006). This developmental progress is usually described as occurring along the dimension of linguistic complexity. Additionally, many different tasks have been used to assess PA, ranging from simple detection tasks (e.g., identification of rhyming words) to tasks requiring synthesis of sounds (e.g., blending phonemes together to make a word) to tasks requiring analysis of components of words (e.g., segmenting words, counting phonemes).

To address the possibility that different aspects of PA, in terms of level of either linguistic complexity or cognitive operation required, have stronger or weaker relations with conventional literacy outcomes, all of the PA measures were coded into subcategories. One subcategory coding reflected the level of linguistic complexity (i.e., phoneme, subphoneme, rhyme, or a combination). A second subcategory coding reflected the type of cognitive operation required (i.e., identification, synthesis, analysis, or a combination). Again, analyses were restricted to outcomes involving either decoding or reading comprehension because of the limited number of studies that included spelling as an outcome.

Results for the different levels of linguistic complexity assessed by PA tasks are shown in Table 2.11. As noted in the table, the results were not influenced by whether the outcome measure was decoding or reading comprehension. As with the analyses of the oral language subcategories, the composite PA measures had the highest predictive relationship with decoding. In terms of the specific levels of linguistic complexity, phonemic awareness had the highest correlation with decoding and reading comprehension; however, the difference between phonemic awareness and subphonemic awareness (e.g., syllable awareness) was not significant. For decoding but not reading comprehension, phoneme awareness was a significantly stronger predictor than was rhyme awareness. Correlations for rhyme awareness and subphoneme awareness did not differ significantly from each other for either decoding or comprehension.

Results for the different cognitive operations required on the PA measures are shown in Table 2.12. With the exception of the strength of the correlation for identity tasks, the results were similar for decoding and reading comprehension. Again, the composite measure was the strongest predictor of decoding. For decoding, analysis tasks were a significantly stronger predictor than either synthesis tasks or identity tasks. For reading comprehension, analysis tasks were a significantly stronger predictor than synthesis tasks but did no better than identity tasks. The correlations for synthesis tasks were not significantly different from the correlations for identity tasks for either decoding or reading comprehension.

Table 2.11. Average Correlations for Prediction of Decoding and Reading Comprehension by Variables Measuring Phonological Awareness at Different Levels of Linguistic Complexity

Level of Linguistic Complexity	Decoding			Reading Comprehension			Comparison
	Avg. *r*	95% CI		Avg *r*	95% CI		
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Overall	0.39	0.38	0.40	0.42	0.39	0.45	D = RC
Composite	0.47	0.43	0.50	0.36	0.29	0.44	D = RC
Phoneme	0.42	0.39	0.44	0.44	0.38	0.48	D = RC
Subphoneme	0.36	0.33	0.39	0.44	0.39	0.48	D = RC
Rhyme	0.29	0.25	0.33	0.38	0.29	0.47	D = RC

Note: D = decoding; RC = reading comprehension.

Table 2.12. Average Correlations for Prediction of Decoding and Reading Comprehension by Variables Measuring Phonological Awareness Using Different Cognitive Operations

Cognitive Operation	Decoding			Reading Comprehension			Comparison
	Avg. *r*	95% CI		Avg *r*	95% CI		
		Lower Bound	Upper Bound		Lower Bound	Upper Bound	
Overall	0.39	0.38	0.41	0.42	0.39	0.44	D = RC
Composite	0.48	0.45	0.52	0.44	0.33	0.54	D = RC
Analysis	0.44	0.42	0.46	0.47	0.42	0.51	D = RC
Synthesis	0.36	0.32	0.39	0.31	0.24	0.38	D = RC
Identity	0.31	0.28	0.34	0.40	0.36	0.45	D < RC

Note: D = decoding; RC = reading comprehension

As with the findings from the analysis of the subcategories of oral language skills, these results are potentially instructive for early childhood education. In contrast to the results from the analysis of the subcategories of oral language skills, however, these findings do not suggest a strong division between the types of PA demonstrated by children with respect to later conventional literacy skills. That is, the specific level of linguistic complexity mattered little in the strength of the relation to conventional literacy skills, although measures of rhyme were consistently the weakest predictor. What is likely more important is that assessment and instructional activities occur within a child's developmental level along the developmental continuum of PA. There was a consistent and significant advantage for analysis tasks over synthesis tasks and identity tasks. This likely indicates a deeper ability to manipulate the sounds in words, reflecting a level closer to achieving the alphabetic principle.

Overall Summary

These results provide compelling evidence as to what some of the important early developing precursor skills are to reading, writing, and spelling development. Across three different outcome domains—decoding, reading comprehension, and spelling—a consistent collection of predictor

variables emerged that possess moderate to strong relationships to these important outcomes. In many cases, these variables provided significant prediction of later literacy outcomes even when other variables were controlled. Based on these findings, there is strong evidence for the importance of AK, PA, rapid naming tasks, "writing or writing name," and phonological STM as predictors of later reading and writing skills. Less consistent evidence exists for the importance of oral language and concepts about print as predictors of later reading and writing skills, mainly because these variables do not always continue to predict literacy outcomes once other variables, such as AK or PA, are controlled. There was weak evidence for the importance of visual perception skills as a predictor of later reading and writing skills, because a moderate relationship emerged for only one outcome variable and because it did not continue to predict literacy outcomes once other variables, such as AK or PA, are controlled.

The secondary analyses revealed that the important predictor variables continued to have moderate to strong relationships with later measures of literacy regardless of the age at which the predictor variable was assessed (e.g., preschool versus kindergarten) or the age at which the outcome variable was assessed (e.g., kindergarten versus first or second grade). Although there were some minor differences involving age of assessment of the predictor variable, age did not influence the strongest predictor variables. Greater differences were observed depending on when the outcome assessments were administered; generally, there were higher correlations with kindergarten outcomes than with first- or second-grade outcomes. However, this is most likely due to the closer time proximity of these assessments than to age differences, per se.

Implications for Research and Practice

These findings have implications for practices in early childhood education. First, the pattern of findings is strikingly consistent and identifies key skills that can serve as important, reliable, and stable indicators for identifying children's development toward acquiring conventional literacy skills. Early childhood educators interested in monitoring children's progress or in identifying those children who need targeted intervention to promote early literacy skills should use assessments that provide reliable and valid measurement of these skills. The findings also suggest that instruction focused on these skills may provide valuable literacy preparation, particularly for children at risk for developing reading difficulties. These findings provide guidance to early childhood educators for selecting appropriate curricula for the children they serve, and they provide guidance to curriculum developers concerning the skills that should be targeted within instructional activities.

The results suggest a need for more careful study of the role of oral language in literacy development. Some aspects of oral language were clearly more strongly related to later literacy outcomes than were other aspects of oral language. Notably, measures of simple vocabulary knowledge were fairly weak predictors of later decoding and reading comprehension, and these measures tended to not remain significant when other variables were included in multivariate analyses. In contrast, more complex aspects of oral language, such as grammar, definitional vocabulary, and listening comprehension, had more substantial predictive relations with later conventional literacy skills. These results suggest that an instructional focus on vocabulary during the preschool and kindergarten years is likely a necessary but insufficient approach to promoting later literacy success.

The value of these variables for predicting later literacy success is without question, and future research could help to provide systematic investigation into which combinations of predictors would work best in various contexts. There is less certainty that teaching these variables early on will result in later achievement improvement. This is because these studies provide correlational data, and such data are not sufficient for determining a causal connection between these factors and later learning.

Results from the analysis of findings related to PA appear to have instructional implications for early childhood educators. These findings suggest the importance of attending to children's progress along a developmental continuum of PA, rather than an emphasis on particular PA skills. These analyses did not reveal important differences in phonological memory, synthesis, or segmentation. However, they do suggest an order to the development of all of these skills across a progression of smaller and smaller units of sound. Rather than trying to teach any particular skill (such as phonological STM), it may be of greater value to ensure that progress is occurring and that children are becoming progressively more able to deal with smaller and smaller units of sound (e.g. words, syllables, onset rimes, phonemes).

In addition to more research into the role of oral language in literacy development, additional work concerning the causal status of these predictor variables is needed. One avenue of research might examine the predictive significance of the variables identified as consistent predictors of conventional literacy outcomes in the context of each other. Future research could profitably examine interventions designed to promote development of the skills identified here; such investigations should both explore the impact of the interventions on the development of the proximal skills and, most importantly, examine how children fare on distal conventional literacy outcomes. Although the upcoming chapters of this report will show what is known about the effectiveness of various approaches for teaching some of these skills (as well as conventional literacy skills), this work is limited to studies already in the published literature, most of which do not report longer-range follow-ups.

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Chapter 3

IMPACT OF CODE-FOCUSED INTERVENTIONS ON YOUNG CHILDREN'S EARLY LITERACY SKILLS

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The National Early Literacy Panel (NELP) identified 83 studies that examined the effectiveness of various interventions that attempted to teach children code-related skills. Interventions in this category focused on teaching aspects of the alphabetic principle (i.e., the knowledge that letters in written words represent the sounds in spoken words). This was the largest collection of intervention studies that the panel reviewed, and it included interventions aimed at the development of phonological awareness (PA), alphabet knowledge (AK), and early decoding skills (i.e., phonics). The studies analyzed in this chapter are listed at the end of the chapter. Most often, the children in these studies were attending some type of preschool or kindergarten program, and the interventions were implemented in addition to whatever education activities were already part of their preschool or kindergarten experiences. Children in the comparison groups usually received the regular (often unspecified) activities of their preschool or kindergarten programs, but sometimes the comparison-group children received an alternative intervention designed to provide a specific contrast to the code-focused teaching.

As described in the preceding chapter, the criterion for inclusion of a study into the NELP analyses of intervention effects included (a) use of a group-comparison design (randomized control trial [RCT] or quasiexperimental design [QED]), (b) use of outcome measures that were assessments either of a conventional literacy skill (i.e., decoding, reading comprehension, spelling) or of one of the skills that the NELP analyses identified as a predictor of later literacy skills, and (c) reported sufficient information to allow an effect size (ES) to be calculated. Studies that used a QED were required to have evidence of initial group comparability (i.e., the groups had pretest scores within 0.5 standard deviation of each other).

Virtually all studies in this category of interventions included some form of PA training. These interventions involved training children either individually or in small groups to identify sounds in words (e.g., match words with the same initial sound) or, more often, to manipulate sounds in words (e.g., combine sounds to form words, segment or delete parts of words). In some studies, these PA training activities were combined with other code-focused training activities, forming two broad categories of combined interventions. One category of combined interventions included studies in which the activities included both PA training and training activities designed to teach children AK, such as letter names or, occasionally, both letter names and letter sounds. The second category of combined interventions included studies of training activities that combined PA instruction and instruction in some aspect of phonics or decoding. Often, this phonics training involved teaching children about letters and simple decoding tasks involving the use of letter sounds. There were also three studies that evaluated the effectiveness of alphabet instruction alone (all three of these studies in this category examined the impact of exposure to Sesame Street®–like video materials).

In analyzing the results from these studies, the first question was whether these code-focused interventions were effective in promoting young children's early literacy and conventional literacy skills across a broad range of outcome measures. These analyses were followed by analyses designed to answer questions concerning the relative impacts of different kinds of code-focused interventions and how these interventions worked with various developmental and demographic categories of children. Thus, these analyses reveal whether and how much code-focused interventions positively influence young children's early literacy and conventional literacy skills, as well as whether various instructional or child characteristics moderate these overall impacts.

Overall Estimates of Intervention Impacts

The results related to the overall impacts of this group of intervention studies across all outcome variables are presented in Table 3.1. The data reported in the table include the outcome variables, the numbers of studies that contributed to the effect estimates, an estimate of the ESs based on a fixed-effect model, an estimate of the ESs based on a random-effect model,[1] the 95 percent upper and lower bound of the ESs based on the random-effect model, and the statistical significance of the ESs from the random-effect model. A large number of studies in this category examined the impacts of the interventions on outcome variables reflecting PA (51 studies), AK (24 studies), reading (36 studies), spelling (15 studies), and oral language (14 studies). Fewer studies of these interventions examined the impacts on outcome variables reflecting general cognitive ability (two studies); memory (nine studies); print knowledge (five studies); rapid automatic naming (RAN) (eight studies); reading readiness (three studies); and writing (five studies). None of these studies considered the impact of the interventions on visual or perceptual processing as an outcome variable. It should be noted that, although specific tests of cognitive ability or memory per se were not identified in Chapter Two as being particular predictors of later literacy achievement, such measures are clearly implicated in various IQ tests, which were identified as significant predictors in Chapter Two. Therefore, the results of these measures are reported in these tables, since they were used in the various qualifying studies. It is possible that the pool of data on these unsearched-for variables would include more studies than were examined here.

[1] Except where noted, all ES estimates and associated statistics are based on a random-effect model.

Table 3.1. Estimates of Effect Sizes Across Outcome Domains for Interventions Classified as Code-Focused for Each Dependent Variable

Dependent Variable	Fixed ES	Random ES	95% CI		*N of Studies*	*p* for ES
			Lower Bound	Upper Bound		
AK	0.31	0.38	0.18	0.58	24	0.0002
Cognitive ability	–0.47	–0.41	–0.78	–0.01	2	0.04
Memory	0.20	0.27	0.06	0.48	9	0.01
Oral language	0.27	0.32	0.09	0.56	14	0.008
PA	0.76	0.82	0.68	0.96	51	< 0.0001
Print knowledge	0.44	0.47	0.18	0.76	5	0.0013
RAN	0.35	0.38	0.08	0.69	8	0.013
Reading readiness	0.20	0.20	0.02	0.38	3	0.034
Reading	0.41	0.44	0.27	0.60	36	< 0.0001
Spelling	0.55	0.61	0.43	0.80	15	< 0.0001
Writing	0.43	0.61	0.18	1.04	5	0.006

As can be seen in Table 3.1, code-focused interventions usually had moderate to large effects both on measures of conventional literacy (i.e., reading, spelling) and on measures of precursor literacy skills (e.g., PA, AK). ESs of the interventions across all outcome variables were statistically reliable (i.e., $p < 0.05$). In all but one case, the average ESs for code-focused interventions were positive. Based on two studies, the impact of code-focused intervention on children's cognitive skills just achieved significance, and the average effect was negative. However, this category of outcome variable had too few studies to allow unambiguous interpretation. Consequently, the results reported in Table 3.1 indicate that code-focused interventions have a significant, substantial, and positive impact both on young children's conventional literacy skills and on early skills that predict later literacy achievement.

The largest impact of code-focused interventions was on PA, with an average ES of 0.82. This result means that, on average, children who received a code-focused intervention scored 0.82 of a standard deviation higher on measures of PA than did children who did not receive a code-focused intervention. To put this in context, if the average children not receiving a code-focused intervention scored 100 on a standardized test of PA that had a mean of 100 and a standard deviation of 15, the average children receiving a code-focused intervention scored 112 on the test (i.e., the difference between scoring at the 50th and 79th percentiles).

The confidence intervals (CIs) reported in Table 3.1 can be used to compare the values of observed ESs across the outcome variables. The 95 percent CI (i.e., upper and lower bounds of the ES) establishes the likely true value of the ES. That is, given the range of ESs observed across studies, the true value of the ES is likely to fall within the CI 95 percent of the time. The CI for an ES is affected by the variation in the ESs across studies as well as the number of studies included (e.g., a wider range of observed ESs and a smaller number of studies result in larger CIs). If the CIs do not overlap, the ESs are significantly different from each other at the $p < 0.05$ level.

The impact of code-focused interventions on PA was significantly larger than the impacts of code-focused interventions on oral language, AK, memory, reading readiness, and reading. The impacts of code-focused interventions on print knowledge, RAN, spelling, and writing were not statistically lower than their impact on PA. Finally, the impacts of code-focused interventions were statistically equal across conventional literacy outcome measures (i.e., reading, spelling, writing).

Estimates of Intervention Impacts by Characteristics of Interventions and Populations

In addition to the analyses of the overall effects of code-focused interventions on children's literacy development, analyses were conducted that addressed questions about the effects of different types of code-focused interventions and on how code-focused interventions differed in their impacts on children's skills across different population characteristics of the samples included in the studies. These estimations of effects by subcategory of intervention or population characteristic could be conducted only in cases in which sufficient numbers of studies used a specific outcome measure. Using a criterion of 10 or more studies[2] that used a particular outcome measure, sufficient studies examined the impact of code-focused interventions on PA, AK, oral language, reading, and spelling to allow subanalyses to be conducted for these outcome domains.

It is important to note that most of the code-focused interventions examined here were implemented using individual or small-group instruction or the studies were unclear about how the instruction was delivered. Because of this, it is not possible, on the basis of these analyses, to determine the effectiveness of whole-class or large-group code-focused instruction with young children.

First, analyses were conducted to determine whether there were any differences in ES estimates based on the type of study design (e.g., RCT versus QED). A summary of the results for each of the five outcome variables is shown in Table 3.2. Complete results for these subanalyses are included in Appendix 3.A. ES estimates were similar for RCTs and QEDs for the PA outcomes ($Q[1, 44] = 1.28$, $p = 0.26$), the oral language outcomes ($Q[1, 10] = 0.42$, $p = 0.51$), the reading outcomes ($Q[1, 29] = 0.16$, $p = 0.69$), and the spelling outcomes ($Q[1, 12] = 1.31$, $p = 0.25$). The ES estimates for the AK outcomes were larger when the study design was RCT than when the study design was QED ($Q[1, 19] = 5.76$, $p = 0.016$). For the majority of outcome variables, type of study did not have a significant influence on the estimated impact of the code-focused interventions.

Table 3.2. Summary of Effect Sizes for Outcome Variables for Study Classification Based on Type of Study

	ESs for Outcome Variable and (*n*) of Studies Contributing to ES				
Design of Study	**PA**	**AK**	**Oral Language**	**Reading**	**Spelling**
RCT	0.87*** (25)	0.66*** (12)	0.25 (4)	0.55*** (15)	0.45** (7)
QED	0.70*** (21)	0.16 (9)	0.44* (8)	0.47*** (16)	0.64*** (7)

*Note: ESs based on random-effect model. *p < 0.05, **p < 0.01, ***p < 0.001*

[2] The limit of 10 studies was an arbitrary criterion. However, given that most planned subanalyses involved three or more categories, 10 was judged the number that would maximize the number of outcome variables included and minimize the subcategories with no studies for an analyzed outcome variable.

Analysis of Intervention Effects by Children's Age and Developmental Level

The studies involving the impacts of code-focused interventions could have included a broad age range of children, but, in fact, few studies investigated the effects of these interventions with very young children. Most of the children in these studies were three, four, or five years old. However, it is possible that, for developmental or experiential reasons, the impact of these interventions differed for children who were preschool age and those who were already in kindergarten. To examine whether code-focused interventions had different effects depending on the age of the children in the study, where possible,[3] studies were divided into two groups: one group of studies in which all of the children were not yet in kindergarten and one group of studies in which all of the children were in kindergarten. Studies with blended samples were excluded from the analyses (i.e., studies that combined the results of preschool- and kindergarten-age children in the same analyses were not used in this comparison).

A summary of the estimates of ESs of code-focused interventions for preschool-age and kindergarten-age children separately is shown in Table 3.3. Complete results for these subanalyses are included in Appendix 3.B. There were no statistically significant differences in the ES estimates for PA ($Q[1, 46] = 0.10$, $p = 0.75$), AK ($Q[1, 21] = 2.21$, $p = 0.14$), oral language ($Q[1, 12] = 0.09$, $p = 0.76$), reading ($Q[1, 32] = 1.48$, $p = 0.22$), and spelling ($Q[1, 13] = 0.55$, $p = 0.46$). ESs were somewhat larger for studies that included preschool children than for those that included kindergarten children for AK, reading, and spelling outcomes; these differences were not statistically reliable. The separate ESs for preschool- and kindergarten-age children continued to be statistically reliable (except for the ES estimates for these interventions with oral language outcomes).

Table 3.3. Summary of Effect Sizes for Outcome Variables for Study Classification Based on Age of Children in Study

	ESs for Outcome Variable and (*n*) of Studies Contributing to ES				
Age Group	**PA**	**AK**	**Oral Language**	**Reading**	**Spelling**
Preschool	0.87*** (10)	0.67** (5)	0.26 (3)	0.75** (4)	0.78** (2)
Kindergarten	0.81*** (38)	0.32** (18)	0.34* (11)	0.43*** (30)	0.58*** (13)

*Note: ESs based on random-effect model. *p < 0.05, **p < 0.01, ***p < 0.001.*

A second set of subanalyses examined whether the estimated ESs varied as a function of the child's developmental level in terms of literacy skills prior to intervention. When the studies provided information, the studies were classified as including children who (a) had little or no AK but were not yet readers, (b) had moderate to high AK but were not yet readers, or (c) were already readers. Studies that did not report children's prior literacy knowledge or studies with blended samples (i.e., studies that included children with a broad range of prior literacy knowledge) were excluded from these subanalyses. The majority of the studies examining code-focused interventions either did not report this information for the sample or included children across a wide range of prior literacy knowledge.

[3] Because meta-analysis requires that a study contribute only one effect size to an analysis, studies that included samples that represented both preschool children and kindergarten children and that did not report separate analyses for preschool and kindergarten children could not be used in these analyses.

A summary of the results of these subanalyses is shown in Table 3.4. Complete results for these subanalyses are included in Appendix 3.C. ES estimates did not vary significantly as a function of children's prior literacy level for the PA outcomes ($Q[2, 19] = 1.43$, $p = 0.49$), oral language outcomes ($Q[1, 4] = 1.71$, $p = 0.10$), reading outcomes ($Q[2, 10] = 2.05$, $p = 0.36$), or spelling outcomes ($Q[2, 5] = 0.49$, $p = 0.78$). ES estimates were significantly different for AK outcomes across children's prior literacy levels ($Q[1, 8] = 6.32$, $p = 0.012$) (see Tables 3.4 and 3.B.2). ESs were larger for children with little or no prior AK than they were for children who had already had moderate to high prior levels of AK. This difference is likely the result of a ceiling effect on measures of AK (i.e., there was less possibility to measure growth in AK for children who had high levels of AK prior to the intervention).

Table 3.4. Summary of Effect Sizes for Outcome Variables for Study Classification Based on Prior Literacy Level of Study Sample

	ESs for Outcome Variable and (*n*) of Studies Contributing to ES				
Prior Literacy Level	**PA**	**AK**	**Oral Language**	**Reading**	**Spelling**
Little letter knowledge	0.99** (5)	0.86** (4)	0.07 (3)	0.92* (4)	0.90 (2)
Letter knowledge but nonreader	0.87*** (15)	0.09 (5)	0.31 (3)	0.38 (7)	0.70* (5)
Reader	1.36** (2)	— (0)	— (0)	0.35 (2)	0.53 (1)

*Note: ESs based on random-effect model. *p < 0.05, **p < 0.01, ***p < 0.001.*

Overall, these two sets of subanalyses indicate that the strong, positive, and statistically significant impacts of code-focused interventions on children's skills in the domains of PA, AK, oral language, reading, and spelling reported for the overall analyses hold regardless of the age of the children included in the studies and, for most outcomes, the prior literacy levels of the children included in the studies. These findings are important because they indicate (a) that it is possible to affect substantially those skills that are most predictive of later decoding, reading comprehension, and spelling for preschool-age children; (b) that these interventions show positive effects on reading and spelling skills (presumably mediated, in part, by the positive impacts on PA and AK); (c) that these results can be obtained with preschool-age children as well as with kindergarten children; and (d) that these substantial impacts are consistent regardless of children's existing early literacy skills.

Analysis of Intervention Effects, by Type of Intervention

As noted previously, code-focused interventions were classified into four categories: (a) interventions that included PA instruction only, (b) interventions that included both PA instruction and AK instruction, (c) interventions that included AK instruction only, and (d) interventions that included both PA instruction and phonics instruction. For each of the five outcome variables with sufficient studies to allow subanalyses, ESs were computed separately for each of these four subtypes of code-focused intervention. The estimates of ESs from these analyses are shown in Tables 3.5 through 3.9.

Table 3.5. Impact of Code-Focused Interventions on Phonological Awareness Outcome by Nature of Intervention in Study

Intervention	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
PA training only	0.91	0.12	0.68	1.15	7.54	21	< 0.00001
PA and AK training	0.70	0.13	0.45	0.95	5.43	18	< 0.00001
AK training only	0.48	0.49	–0.47	1.43	0.99	1	0.3288
PA and phonics training	0.74	0.13	0.49	0.99	5.84	19	< 0.00001

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.6. Impact of Code-Focused Interventions on Alphabet Knowledge Outcome by Nature of Intervention in Study

Group	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
PA training only	0.04	0.11	–0.19	0.26	0.31	6	0.76
PA and AK training	0.37	0.13	0.11	0.62	2.80	7	0.012
PA and phonics training	0.57	0.12	0.34	0.81	4.75	9	< 0.0001

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison,, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.7. Impact of Code-Focused Interventions on Oral Language Outcome by Nature of Intervention in Study

Group	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
PA training only	0.09	0.13	–0.18	0.35	0.65	4	0.54
PA and AK training	0.13	0.17	–0.20	0.46	0.75	4	0.47
AK training only	0.83	0.27	0.30	1.36	3.05	1	< 0.014
PA and phonics training	0.68	0.17	0.34	1.02	3.90	4	< 0.004

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.8. Impact of Code-Focused Interventions on Reading Outcome by Nature of Intervention in Study

Intervention Type	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
PA training only	0.19	0.16	–0.12	0.50	1.22	10	0.23
PA and AK training	0.31	0.14	0.04	0.59	2.22	13	0.033
AK training only	–0.52	0.46	–1.42	0.37	–1.15	1	0.26
PA and phonics training	0.66	0.13	0.41	0.92	5.08	17	0.00001

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison,, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.9. Impact of Code-Focused Interventions on Spelling Outcomes by Nature of Intervention in Study

Intervention Type	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
PA training only	0.59	0.18	0.23	0.95	3.20	4	0.006
PA and AK training	0.50	0.14	0.21	0.78	3.44	6	0.0037
PA and phonics training	0.59	0.13	0.34	0.83	4.64	8	0.0003

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability

There were no significant differences between ESs of the different categories of code-focused intervention for the PA outcome variable (Table 3.5) ($Q[3, 55] = 2.07$, $p = 0.56$) or the spelling outcome variable (Table 3.9) ($Q[2, 15] = 0.24$, $p = 0.89$). ESs did differ significantly between subcategories of code-focused interventions for the AK outcome variable (Table 3.6) ($Q[2, 19] = 10.76$, $p = 0.005$), the oral language outcome variable (Table 3.7) ($Q[3, 9] = 12.05$, $p = 0.007$), and the reading outcome variable (Table 3.8) ($Q[3, 37] = 10.27$, $p = 0.02$). For the AK outcome, the ES estimate for the PA training–only condition was significantly smaller than that for PA and phonics training, suggesting a degree of specificity between the knowledge and skills targeted by the intervention and the measured impact on children's skills. For the oral language and reading outcome variables, the ES estimate from the single study for AK training only was either substantially higher or substantially lower than those from the other forms of intervention. However, because only one study contributed to the ES estimate for the effect of AK training, these results are not interpretable.

The results of these analyses indicate that the impacts of most code-focused interventions are positive, moderate to large, and statistically reliable across a broad range of key early literacy and reading indicators (i.e., PA, AK, reading, spelling). Not surprisingly, the interventions that did not include a print-focused component (i.e., those with PA training only) had a significantly weaker effect on print-specific outcomes (i.e., AK). Regardless, the results were generally consistent across outcome domains, indicating that interventions that include variations of PA training affect not only PA skills but also measures of reading and spelling.

In addition to examining the relative impacts of different types of code-focused interventions, the relative impacts of variations in the nature of the PA interventions were examined. PA varies along at least two independent dimensions: level of linguistic complexity and cognitive operation. *Level of linguistic complexity* refers to the size of the sound unit on which PA is demonstrated, and it ranges along a continuum from word-level units to phoneme-level units. The target skill of different PA interventions is sometimes one point on this continuum and sometimes multiple levels of this continuum. A common theoretically relevant split on this continuum is phoneme-level tasks or targets (i.e., phonemic awareness) versus subphonemic tasks or targets (i.e., syllable awareness, onset-rime awareness). *Cognitive operation* refers to the type of task performed on these linguistic units and can involve identity (e.g., rhyme oddity detection), synthesis (e.g., blending or putting linguistic units together to form new linguistic units, typically words), or analysis (e.g., separating a linguistic unit from a larger linguistic unit through deletion or counting), with analysis tasks often considered the more developmentally advanced cognitive operation.

Studies that provided the necessary information were classified as including PA interventions that involved a focus on (a) phonemic awareness, (b) subphonemic awareness, or (c) both phonemic and subphonemic awareness. The studies also were classified as including interventions that focused on (a) analysis skills, (b) synthesis skills, or (c) both analysis and synthesis skills. Few or no interventions focused solely on identity skills, and therefore, identity-focused PA intervention was not a category that was analyzed. Studies that did not report sufficient details about the nature of the PA intervention in terms of either linguistic complexity or cognitive operation were excluded from these analyses. More than half of the studies examining code-focused interventions involving a component of PA training could be classified for level of linguistic complexity or cognitive operation.

A summary of the results of the analyses for level of linguistic complexity targeted by the PA intervention is shown in Table 3.10. Complete results for these analyses are included in Appendix 3.D. ES estimates did not vary significantly as a function of level of linguistic complexity targeted by the intervention for PA outcomes ($Q[2, 37] = 4.19$, $p = 0.12$), AK outcomes ($Q[2, 14] = 3.26$, $p = 0.20$), oral language outcomes ($Q[2, 7] = 2.81$, $p = 0.25$), reading outcomes ($Q[2, 25] = 0.96$, $p = 0.62$), or spelling outcomes ($Q[2, 11] = 0.54$, $p = 0.76$). That is, regardless of whether the nature of the PA training involved phonemic-level tasks, subphonemic-level tasks, or a combination of phonemic- and subphonemic-level tasks, the estimated ESs were statistically similar, suggesting that variations along the continuum of linguistic complexity yield comparable positive effects on key early literacy and literacy measures for this age group of children.

Table 3.10. Summary of Effect Sizes for Outcome Variables for Study Classification Based on Focus of Phonological Awareness Training

	ESs for Outcome Variable and (*n*) of Studies Contributing to ES				
Focus of PA Training	**PA**	**AK**	**Oral Language**	**Reading**	**Spelling**
Subphonemic	1.10*** (14)	0.62** (7)	0.64* (3)	0.41 (8)	0.76** (3)
Phonemic	0.71*** (7)	0.14 (1)	0.23 (1)	0.67** (7)	0.71* (2)
Both	0.75*** (19)	0.21 (9)	0.14 (6)	0.45** (13)	0.58*** (9)

*Note: ESs based on random-effect model. *p < 0.05, **p < 0.01, ***p < 0.001.*

A summary of the results of the analyses for the cognitive operation targeted by the PA intervention is shown in Table 3.11. Complete results for these analyses are included in Appendix 3.E. ES estimates did not vary significantly as a function of the type of cognitive operation targeted by the intervention for PA outcomes ($Q[2, 33] = 0.20$, $p = 0.91$), AK outcomes ($Q[1, 10] = 0.55$, $p = 0.46$), oral language outcomes ($Q[1, 6] = 0.23$, $p = 0.63$), reading outcomes ($Q[2, 19] = 2.93$, $p = 0.23$), or spelling outcomes ($Q[2, 10] = 1.84$, $p = 0.40$). As for the analyses for type of cognitive operation targeted by PA interventions, regardless of whether the nature of the PA training involved analysis tasks, synthesis tasks, or a combination of analyses and synthesis tasks, the estimated ESs were statistically similar, suggesting that variations in the type of cognitive operation used in PA training yield comparable positive effects on key early literacy and literacy measures for this age group of children.

Table 3.11. Summary of Effect Sizes for Outcome Variables for Study Classification Based on Nature of Phonological Awareness Training

	ESs for Outcome Variable and (*n*) of Studies Contributing to ES				
Type of PA Training	**PA**	**AK**	**Oral Language**	**Reading**	**Spelling**
Analysis	0.88*** (8)	0.13 (3)	0.13 (1)	0.13 (5)	0.53** (4)
Synthesis	0.72* (5)	— (0)	— (0)	0.45 (2)	–0.16 (1)
Both	0.83*** (23)	0.34* (9)	0.39 (7)	0.49*** (15)	0.56*** (8)

*Note: ESs based on random-effect model. *p < 0.05, **p < 0.01, ***p < 0.001.*

Analysis of Intervention Effects by Demographics of Study Samples

For all analyses of intervention effects, NELP examined variations in estimated ESs for a common set of demographic variables. The demographic variables in these analyses included the socioeconomic status (SES) of the families of the children included in the study samples, ethnic classification of study participants, and the population density of the location where the study was conducted (i.e., rural, urban, suburban, mixed, unknown). These analyses allow both an examination of reliable systematic variation across categories of these demographic variables and a summary of the texture of the literature regarding code-focused interventions for children in preschool or kindergarten. In the majority of studies included in the summary of code-focused interventions, either these demographic characteristics were not reported or the samples used in the studies represented a mix of the demographic categories.

A summary of the results of the analyses for ESs based on the SES of the study samples in code-focused interventions is shown in Table 3.12. Complete results for these analyses are included in Appendix 3.F. ES estimates did not vary significantly as a function of the SES classification of the study samples for the AK outcomes ($Q[2, 9] = 0.06$, $p = 0.97$), oral language outcomes ($Q[2, 5] = 0.18$, $p = 0.92$), or reading outcomes ($Q[2, 7] = 0.40$, $p = 0.82$). ES estimates did vary as a function of SES for the PA outcomes ($Q[2, 16] = 7.30$, $p < 0.03$) and spelling outcomes ($Q[1, 4] = 5.35$, $p = 0.02$). CIs shown in Table 3.E.1 indicate that, for PA outcomes, studies with samples classified as mixed SES had smaller ESs than did studies with samples classified as not–low SES. CIs shown in Table 3.E.5 indicate that, for spelling outcomes, studies with samples classified as low SES had smaller ESs than did studies with samples classified as not–low SES. In both cases of statistically significant variation in ESs, however, it is likely that the small number of studies classified as mixed SES (PA outcomes) or low SES (spelling outcomes) contributed to this finding and should, therefore, not be given substantial interpretive credence.

A summary of the results of the analyses for ESs of code-focused interventions based on the ethnicity of the study samples is shown in Table 3.13. Complete results for these analyses are included in Appendix 3.G. ES estimates did not vary significantly as a function of the ethnicity classification of the study samples for the PA outcomes ($Q[2, 45] = 2.81$, $p = 0.25$), AK outcomes ($Q[1, 21] = 0.10$, $p = 0.75$), oral language outcomes ($Q[1, 12] = 2.02$, $p = 0.16$), or reading outcomes ($Q[1, 32] = 0.05$, $p = 0.82$). All studies with spelling outcomes were classified as mixed

ethnicity or unknown. It is important to note that the majority of studies included in these analyses had samples that were classified as mixed or unknown ethnicity. Consequently, the absence of statistically reliable variability in ESs dependent on the ethnicity of the children has not been adequately tested. Based on existing studies, however, there is no evidence on which to conclude that children's ethnicity moderates the positive effects of code-focused interventions.

Table 3.12. Summary of Effect Sizes for Outcome Variables for Study Classification Based on Socioeconomic Status of Study Sample

	ESs for Outcome Variable and (*n*) of Studies Contributing to ES				
SES Classification	**PA**	**AK**	**Oral Language**	**Reading**	**Spelling**
Low	0.81*** (9)	0.40 (6)	0.26 (5)	0.60 (5)	0.76** (5)
Not low	1.42*** (8)	0.49 (5)	0.19 (2)	0.26 (3)	2.00* (1)
Mixed	0.40 (2)	0.33 (1)	0.39 (1)	0.57 (2)	— (0)

*Note: ESs based on random-effect model. *p < 0.05, **p < 0.01, ***p < 0.001.*

Table 3.13. Summary of Effect Sizes for Outcome Variables for Study Classification Based on Ethnicity of Study Sample

	ESs for Outcome Variable and (*n*) of Studies Contributing to ES				
Ethnicity	**PA**	**AK**	**Oral Language**	**Reading**	**Spelling**
Caucasian	1.49** (2)	0.52 (2)	— (0)	0.35 (1)	— (0)
African American	0.41 (1)	— (0)	— (0)	— (0)	— (0)
Hispanic	— (0)	— (0)	0.83* (1)	— (0)	— (0)
Mixed/unspecified	0.81*** (45)	0.39** (21)	0.27* (13)	0.47*** (33)	0.61*** (15)

*Note: ESs based on random-effect model. *p < 0.05, **p < 0.01, ***p < 0.001.*

A summary of the results of the analyses of ESs for code-focused interventions based on population density is shown in Table 3.14. Complete results for these analyses are included in Appendix 3.H. ES estimates did not vary significantly as a function of population density for PA outcomes ($Q[4, 42] = 2.24$, $p = 0.69$), AK outcomes ($Q[3, 19] = 64.78$, $p < 0.0001$), oral language outcomes ($Q[4, 9] = 8{,}49$, $p = 0.08$), reading outcomes ($Q[4, 27] = 1.90$, $p = 0.76$), or spelling outcomes ($Q[3, 10] = 5.56$, $p = 0.14$). Again, most studies were classified as unknown population density. Consequently, the absence of statistically reliable variability in ESs dependent on population density has not been adequately tested. Based on existing studies, however, there is no evidence on which to conclude that population density moderates the positive effects of code-focused interventions.

Table 3.14. Summary of effect sizes for outcome variables for study classification based on population density of study sample

	Effect Sizes for Outcome Variable and (*n*) of Studies Contributing to Effect Size				
Population Density	**Phonological Awareness**	**Alphabet Knowledge**	**Oral Language**	**Reading**	**Spelling**
Rural	.60** (4)	.01 (3)	.08 (2)	.13 (2)	--- (0)
Urban	.93*** (17)	.29** (8)	.81** (3)	.48** (11)	.58*** (8)
Suburban	.90* (2)	--- (0)	.30 (3)	.46 (2)	.71* (1)
Mixed	.92*** (3)	.27 (2)	.05 (2)	.64* (3)	1.19** (1)
Unknown	.74*** (21)	.82*** (10)	.40 (4)	.56*** (14)	.46** (4)

*Note. Effect sizes based on random-effect model. *p < .05, **p < .01, ***p < .001.*

Summary and Conclusions

Results from this meta-analysis of the impacts of code-focused interventions on the early literacy and conventional literacy skills of young children indicate that these interventions yield a moderate to large effect on the predictors of later reading and writing (i.e., PA, AK) and on measures of reading and writing. These effects were robust to variation in the type of code-focused intervention, to variation in children's ages or developmental levels, and to variations in methods of teaching young children PA. At this time, few studies allow fine-grained analysis of other population variables, such as SES, ethnicity, or population density. However, existing studies provide no evidence that the effects of code-focused interventions are altered by these sample characteristics.

The majority of code-focused interventions involved some form of PA training activity. Consequently, most of the substantially positive impacts on children's early literacy skills need to be interpreted in this context. That is, these analyses show that some form of PA training, either alone or in combination with more or less complex instruction related to print knowledge (i.e., letter-name instruction, instruction in early decoding skills) is likely to yield growth in children's skills related to later reading and writing achievement. Whereas the literature contains both debate and findings concerning the type of PA training required to produce positive impacts on reading skills, the results of these analyses did not reveal any statistically reliable differences between variations in PA interventions. Categorizing the nature of PA training according to two theoretically relevant dimensions, the level of linguistic complexity that was the focus of the training and the nature of the cognitive operation taught in the PA training, did not indicate that one form of training was more or less effective than another form of training across a range of outcome measures.

Importantly, there was no evidence that the effectiveness of code-focused interventions was influenced by age or developmental level of the children. That is, the impacts of code-focused interventions were observed in children whether they were preschool age or kindergarten age,

and these interventions were equally successful across a range of levels of prior literacy knowledge (from minimal AK to being able to read). These findings indicate that there is not a point along either an age or a developmental continuum at which code-focused interventions become more or less beneficial to children's early literacy skills. The findings also suggest that there is no preexisting level of knowledge or skill that children must attain before these interventions can be used successfully.

Most of the code-based interventions tested here are not available commercially. The majority of interventions included in these analyses were designed and implemented by researchers, and there was a great deal of variability in the specifics of the various interventions. This suggests that some instructional variations may be more effective than others, so, ultimately, it will be important and necessary to distill the specific components of these interventions to determine what types of intervention activities produce the most positive effects on children's early literacy skills. It is not sufficient to merely label interventions as PA training, phonics, or code focused for them to be effective. Successful code-focused interventions will likely include all or most of the components of the interventions noted in this meta-analysis; thus, interventions should include PA training with activities involving higher-level PA skills, such as actively engaging in analysis or synthesis of words at the syllable, onset-rime, or phoneme level with feedback on correct and incorrect responses. Although PA training can be conducted alone, the results of this meta-analysis suggest that there may be an advantage of combining such training with activities designed to teach children about specific aspects of print, such as letter names and letter sounds.

The majority of the code-focused interventions summarized by this meta-analysis were conducted as either individual-level or small group–level interventions. There was no evidence that whole-class or large-group code-focused interventions will produce similar-sized effects on children's reading-related skills. While it is not the case that research has shown whole-class or large-group implementation of code instruction to be ineffective (such approaches were not tested at all), it would be a mistake to assume that teachers could successfully implement these interventions with large groups. Future research may be able to find how to make such instruction effective when delivered to whole classes or large groups, but, until such work is done, it would be prudent to deliver such instruction in ways more similar to those that were successful. It is likely that, for some of the interventions, a small-group format will be necessary to achieve this level of positive results.

Finally, in addition to providing information about the overall impacts of code-focused interventions as well as the robustness of these interventions across different outcome variables, variations in type of intervention, and populations of children, these analyses provide information on those things that have not yet been studied or have not been studied well to date. Interestingly, we found only one study that investigated the effect of teaching letter knowledge to children. Direct teaching of the alphabet was most generally examined in the context of some form of PA training. Consequently, there is, at present, no interpretable evidence that teaching AK alone is a sufficient technique for enhancing children's reading-related skills.

In some cases, a meta-analysis of existing studies could not be used to address important questions that early childhood educators face. Most notably, extant studies do not allow an adequate examination of the relative effectiveness of code-focused instruction for specific

subpopulations of children. To their credit, most studies included mixed samples of children from different socioeconomic backgrounds, ethnic groups, and living environments (e.g., population density). Unfortunately, the data in these studies were usually not reported in a way that differential effectiveness could be studied. Although the early childhood education field is interested in specific questions about which interventions will work best for children living in poverty, children from traditionally underrepresented ethnic groups, children who are English-language learners, or children growing up in rural or urban environments, there are not yet studies focusing on these specific subpopulations or that allow examination of these subpopulations to answer these questions. Given the clear success of code-focused instruction with these mixed populations, it seems prudent to make such instruction available to all populations of young children, at least until research more directly addresses this question.

Research Studies Synthesized in the Analysis of Code-Focused Interventions

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Appendix 3.A: Summary of Results for Subanalyses Based on the Type of Study Design: Randomized Controlled Trial Versus Quasiexperimental Study

Table 3.A.1. Subanalysis for Phonological Awareness Outcomes by Study Design

Type of Study	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
RCT	0.87	0.10	0.67	1.07	8.44	< 0.00001	25
QED	0.70	0.11	0.49	0.91	6.59	< 0.00001	21

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability

Table 3.A.2. Subanalysis for Alphabet Knowledge Outcomes by Study Design

Type of Study	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
RCT	0.66	0.14	0.38	0.94	4.59	0.0002	12
QED	0.16	0.15	–0.12	0.45	1.12	0.28	9

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability

Table 3.A.3. Subanalysis for Oral Language Outcomes by Study Design

Type of Study	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
RCT	0.25	0.24	–0.22	0.71	1.02	0.33	4
QED	0.44	0.17	0.11	0.76	2.62	0.03	8

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability

Table 3.A.4. Subanalysis for Reading Outcomes by Study Design

Type of Study	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
RCT	0.55	0.14	0.27	0.82	3.82	< 0.0007	15
QED	0.47	0.13	0.21	0.72	3.60	< 0.0012	16

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability

Table 3.A.5. Subanalysis for Spelling Outcomes by Study Design

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
RCT	0.45	0.12	0.21	0.69	3.72	< 0.003	7
QED	0.64	0.11	0.43	0.84	6.05	< 0.0001	7

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability

Appendix 3.B: Summary of Results for Subanalyses Based on Age of Children Included in Study Sample

Table 3.B.1. Impact of Code-Focused Interventions on Phonological Awareness Outcomes by Age of Children in Study

Age Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Preschool	0.87	0.18	0.52	1.22	4.83	0.00002	10
Kindergarten	0.81	0.08	0.64	0.97	9.49	< 0.00001	38

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.B.2. Impact of Code-Focused Interventions on Alphabet Knowledge Outcomes by Age of Children in Study

Age Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Preschool	0.67	0.21	0.26	1.07	3.25	0.004	5
Kindergarten	0.32	0.11	0.12	0.53	3.07	0.006	18

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.B.3. Impact of Code-Focused Interventions on Oral Language Outcomes by Age of Children in Study

Age Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Preschool	0.26	0.25	–0.23	0.74	1.02	0.33	3
Kindergarten	0.34	0.14	0.08	0.61	2.52	0.03	11

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.B.4. Impact of Code-Focused Interventions on Reading Outcomes by Age of Children in Study

Age Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Preschool	0.75	0.25	0.26	1.24	3.02	< 0.005	4
Kindergarten	0.43	0.09	0.25	0.61	4.61	< 0.0001	30

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.B.5. Impact of Code-Focused Interventions on Spelling Outcomes by Age of Children in Study

Age Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Preschool	0.78	0.25	0.29	1.27	3.14	< 0.008	2
Kindergarten	0.58	0.10	0.38	0.79	5.62	< 0.0001	13

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Appendix 3.C: Summary of Results for Subanalyses Based on Prior Level of Literacy Knowledge of Children Included in Study Sample

Table 3.C.1. Subanalysis for Phonological Awareness Outcomes by Children's Prior Level of Literacy Skill

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Little letter knowledge	0.99	0.27	0.46	1.52	3.67	< 0.002	5
Letter knowledge but nonreader	0.87	0.15	0.57	1.16	5.76	< 0.0001	15
Reader	1.36	0.39	0.60	2.12	3.49	< 0.003	2

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.C.2. Subanalysis for Alphabet Knowledge Outcomes by Children's Prior Level of Literacy Skill

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Little letter knowledge	0.86	0.25	0.38	1.34	3.51	< 0.008	4
Letter knowledge but nonreader	0.09	0.19	–0.27	0.45	0.48	0.65	6

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.C.3. Subanalysis for Oral Language Outcomes by Children's Prior Level of Literacy Skill

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Little letter knowledge	0.07	0.13	–0.19	0.32	0.51	0.64	3
Letter knowledge but nonreader	0.31	0.14	0.04	0.59	2.25	0.09	3

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.C.4. Subanalysis for Reading Outcomes by Children's Prior Level of Literacy Skill

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Little letter knowledge	0.92	0.32	0.29	1.55	2.86	< 0.02	4
Letter knowledge but nonreader	0.38	0.23	–0.07	0.83	1.65	0.13	7
Reader	0.35	0.41	–0.46	1.16	0.85	0.41	2

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.C.5. Subanalysis for Spelling Outcomes by Children's Prior Level of Literacy Skill

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Little letter knowledge	0.90	0.35	0.21	1.60	2.55	0.05	2
Letter knowledge but nonreader	0.70	0.21	0.28	1.11	3.32	0.02	5
Reader	0.53	0.40	–0.26	1.32	1.32	0.25	1

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Appendix 3.D: Summary of Results for Subanalyses Based on Classification of Studies for Level of Linguistic Complexity Targeted by the Phonological Awareness Intervention

Table 3.D.1. Subanalysis for Phonological Awareness Outcomes by Level of Linguistic Complexity Targeted by Phonological Awareness Intervention

Linguistic Complexity	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Subphonemic	1.10	0.15	0.81	1.39	7.45	< 0.00001	14
Phonemic	0.71	0.20	0.33	1.10	3.63	< 0.0009	7
Both	0.75	0.12	0.52	0.97	6.45	< 0.00001	19

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate., p = statistical probability.

Table 3.D.2. Subanalysis for Alphabet Knowledge Outcomes by Level of Linguistic Complexity Targeted by Phonological Awareness Intervention

Linguistic Complexity	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Subphonemic	0.62	0.19	0.24	1.00	3.22	< 0.007	7
Phonemic	0.14	0.39	–0.62	0.90	0.35	0.73	1
Both	0.21	0.14	–0.05	0.48	1.56	0.14	9

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.D.3. Subanalysis for Oral Language Outcomes by Level of Linguistic Complexity Targeted by Phonological Awareness Intervention

Linguistic Complexity	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Subphonemic	0.64	0.25	0.14	1.13	2.53	0.04	3
Phonemic	0.23	0.39	–0.53	1.00	0.60	0.57	1
Both	0.14	0.16	–0.16	0.45	0.92	0.39	6

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.D.4. Subanalysis for Reading Outcomes by Level of Linguistic Complexity Targeted by Phonological Awareness Intervention

Linguistic Complexity	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Subphonemic	0.41	0.21	0.00	0.82	1.97	0.06	8
Phonemic	0.67	0.21	0.26	1.09	3.18	< 0.004	7
Both	0.45	0.16	0.14	0.75	2.87	< 0.009	13

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.D.5. Subanalysis for Spelling Outcomes by Level of Linguistic Complexity Targeted by Phonological Awareness Intervention

Linguistic Complexity	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Subphonemic	0.76	0.23	0.31	1.22	3.27	< 0.008	3
Phonemic	0.71	0.27	0.19	1.23	2.69	0.02	2
Both	0.58	0.13	0.33	0.84	4.47	< 0.001	9

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability

Appendix 3.E: Summary of Results for Subanalyses Based on Classification of Studies for Cognitive Operation Targeted by the Phonological Awareness Intervention

Table 3.E.1. Subanalysis for Phonological Awareness Outcomes by Cognitive Operation Targeted by Phonological Awareness Intervention

Operation	Mean ES	SE	95 %CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Analysis	0.88	0.19	0.50	1.26	4.51	< 0.0001	8
Synthesis	0.72	0.29	0.16	1.28	2.53	< 0.02	5
Both	0.83	0.11	0.61	1.04	7.49	< 0.00001	23

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.E.2. Subanalysis for Alphabet Knowledge Outcomes by Cognitive Operation Targeted by Phonological Awareness Intervention

Operation	Mean ES	SE	95 %CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Analysis	0.13	0.24	–0.35	0.61	0.54	0.60	3
Both	0.34	0.13	0.09	0.58	2.67	< 0.03	9

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.E.3. Subanalysis for Oral Language Outcomes by Cognitive Operation Targeted by Phonological Awareness Intervention

Operation	Mean ES	SE	95 %CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Analysis	0.13	0.51	–0.87	1.13	0.25	0.81	1
Both	0.39	0.18	0.04	0.74	2.20	0.07	7

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.E.4. Subanalysis for Reading Outcomes by Cognitive Operation Targeted by Phonological Awareness Intervention

Operation	Mean ES	SE	95 %CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Analysis	0.13	0.18	–0.22	0.49	0.74	0.47	5
Synthesis	0.45	0.34	–0.23	1.12	1.30	0.21	2
Both	0.49	0.11	0.28	0.71	4.57	< 0.001	15

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.E.5. Subanalysis for Spelling Outcomes by Cognitive Operation Targeted by Phonological Awareness Intervention

Operation	Mean ES	SE	95 %CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Analysis	0.53	0.17	0.19	0.87	3.05	< 0.02	4
Synthesis	–0.16	0.53	–1.19	0.87	–0.30	0.77	1
Both	0.56	0.09	0.38	0.75	6.00	< 0.001	8

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Appendix 3F: Summary of Results for Subanalyses Based on Classification of Studies by Socioeconomic-Status Classification of Study Sample

Table 3.F.1. Subanalysis for Phonological Awareness Outcomes by Socioeconomic-Status Classification of Study Sample

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Low SES	0.81	0.18	0.46	1.17	4.52	< 0.001	9
Not low SES	1.42	0.20	1.02	1.82	6.96	< 0.00001	8
Mixed SES	0.40	0.42	–0.42	1.22	0.95	0.36	2

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.F.2. Subanalysis for Alphabet Knowledge Outcomes by Socioeconomic-Status Classification of Study Sample

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Low SES	0.40	0.26	–0.11	0.91	1.55	0.16	6
Not low SES	0.49	0.29	–0.08	1.05	1.68	0.13	5
Mixed SES	0.33	0.68	–1.01	1.67	0.48	0.64	1

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.F.3. Subanalysis for Oral Language Outcomes by Socioeconomic-Status Classification of Study Sample

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Low SES	0.26	0.15	–0.03	0.55	1.77	0.14	5
Not low SES	0.19	0.23	–0.26	0.63	0.81	0.45	2
Mixed SES	0.39	0.45	–0.50	1.28	0.85	0.43	1

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.F.4. Subanalysis for Reading Outcomes by Socioeconomic-Status Classification of Study Sample

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Low SES	0.60	0.33	–0.04	1.24	1.85	0.11	5
Not low SES	0.26	0.45	–0.64	1.15	0.56	0.59	3
Mixed SES	0.57	0.55	–0.50	1.65	1.04	0.33	2

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.F.5. Subanalysis for Spelling Outcomes by Socioeconomic-Status Classification of Study Sample

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Low SES	0.76	0.16	0.44	1.08	4.60	0.01	5
Not low SES	2.00	0.51	1.00	3.00	3.92	0.02	1

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Appendix 3.G: Summary of Results for Subanalyses Based on Classification of Studies by Ethnicity of Study Sample

Table 3.G.1. Subanalysis for Phonological Awareness Outcomes by Ethnicity of Study Sample

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Caucasian	1.49	0.46	0.60	2.38	3.27	0.002	2
African American	0.41	0.52	–0.61	1.43	0.78	0.44	1
Mixed or unspecified	0.81	0.08	0.65	0.96	10.43	< 0.00001	45

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.G.2. Subanalysis for Alphabet Knowledge Outcomes by Ethnicity of Study Sample

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Caucasian	0.52	0.37	–0.22	1.25	1.38	0.18	2
Mixed or unspecified	0.39	0.11	0.18	0.60	3.69	< 0.002	21

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.G.3. Subanalysis for Oral Language Outcomes by Ethnicity of Study Sample

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Latino or Hispanic	0.83	0.37	0.10	1.55	2.23	0.05	1
Mixed or unspecified	0.27	0.12	0.05	0.50	2.38	0.04	13

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.G.4. Subanalysis for Reading Outcomes by Ethnicity of Study Sample

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Caucasian	0.35	0.51	–0.64	1.35	0.70	0.49	1
Mixed/unspecified	0.47	0.09	0.29	0.65	5.13	< 0.0001	33

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.G.5. Subanalysis for Spelling Outcomes by Ethnicity of Study Sample

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Mixed or unspecified	0.62	0.09	0.43	0.79	6.76	< 0.0001	15

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Appendix 3.H: Summary of Results for Subanalyses Based on Classification of Studies by Population Density of Study Location

Table 3.H.1. Subanalysis for Phonological Awareness Outcomes by Population Density of Study Location

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Rural	0.60	0.23	0.15	1.05	2.60	0.01	4
Urban	0.93	0.13	0.67	1.19	7.03	< 0.00001	17
Suburban	0.90	0.37	0.17	1.62	2.42	< 0.02	2
Mixed	0.92	0.27	0.40	1.45	3.43	0.001	3
Not specified	0.74	0.12	0.51	0.97	6.34	< 0.00001	21

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.H.2. Subanalysis for Alphabet Knowledge Outcomes by Population Density of Study Location

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Urban	0.01	0.06	–0.11	0.14	0.23	0.82	3
Rural	0.29	0.10	0.09	0.48	2.85	0.01	8
Mixed	0.27	0.15	–0.03	0.57	1.79	0.09	2
Not specified	0.82	0.08	0.67	0.97	10.47	< 0.001	10

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.H.3. Subanalysis for Oral Language Outcomes by Population Density of Study Location

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Rural	0.08	0.18	–0.28	0.44	0.42	0.69	2
Urban	0.81	0.21	0.39	1.23	3.77	< 0.005	3
Suburban	0.30	0.19	–0.07	0.68	1.59	0.15	3
Mixed	0.05	0.23	–0.39	0.50	0.24	0.82	2
Not specified	0.40	0.18	0.04	0.75	2.20	0.06	4

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.H.4. Subanalysis for Reading Outcomes by Population Density of Study Location

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Rural	0.13	0.31	–0.47	0.73	0.42	0.68	2
Urban	0.48	0.16	0.17	0.79	3.03	< 0.006	11
Suburban	0.46	0.36	–0.25	1.17	1.27	0.21	2
Mixed	0.64	0.28	0.09	1.18	2.30	0.03	3
Not specified	0.56	0.14	0.28	0.83	3.95	0.0005	14

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Table 3.H.5. Subanalysis for Spelling Outcomes by Population Density of Study Location

Group	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
Urban	0.58	0.10	0.38	0.79	5.63	< 0.001	8
Suburban	0.71	0.25	0.21	1.21	2.79	0.02	1
Mixed	1.19	0.29	0.62	1.75	4.12	0.002	1
Not specified	0.46	0.13	0.20	0.71	3.50	< 0.006	4

Note: ES = ES from random-effect model, SE = SE of ES, t = t-statistic for the comparison, n = number of studies contributing to ES estimate, p = statistical probability.

Appendix 3.I: Coding for Articles Involving Code-Focused Interventions

Study	Age[a]	Previous Literacy Skill[b]	Intervention Type[c]	Type of PA Training (Unit)[d]	Type of PA Training (Task)[e]
Ball, E. W., & Blachman, B. A. (1988). Phoneme segmentation training: Effect on reading readiness. *Annals of Dyslexia, 38*, 208–225.	1	—	2	3	1
Beech, J. R., & Pedley, H. (1994). Training letter-to-sound connections: The efficacy of tracing. *Current Psychology, 13*(2), 153–165.	0	2	2	—	—
Brady, S., Fowler, A., Stone, B., & Winbury, N. (1994). Training phonological awareness: A study with inner-city kindergarten children. *Annals of Dyslexia, 44*, 26–59.	1	2	1	3	1
Bus, A. G. (1986). Preparatory reading instruction in kindergarten: Some comparative research into methods of auditory and auditory-visual training of phonemic analysis and blending. *Perceptual and Motor Skills, 62*, 11–24.	1	—	2	2	3
Bus (1986).	1	—	5	2	3
Byrne, B., & Fielding-Barnsley, R. (1991). Evaluation of a program to teach phonemic awareness to young children. *Journal of Educational Psychology, 83*(4), 451–455.	0	—	1	2	—
Cary, L. & Verhaeghe, A. (1994). Promoting phonemic analysis ability among kindergartners. *Reading & Writing: An Interdisciplinary Journal, 6*, 251–278.	0	2	1	3	3
Cary & Verhaeghe (1994).	—	—	1	—	—
Cary & Verhaeghe (1994).	—	—	1	—	—
Castle, J. M., Riach, J., & Nicholson, T. (1994). Getting off to a better start in reading and spelling: The effects of phonemic awareness instruction within a whole language program. *Journal of Educational Psychology, 86*(3), 350–359.	0	1	1	1	1
Castle, Riach, & Nicholson (1994).	—	—	2	—	—
Castle, Riach, & Nicholson (1994).	—	—	2	—	—

	ESs for Primary Outcome Variables				
	PA	AK	Oral Language	Reading	Spelling
	0.92	0.21		0.57	0.43
		0.56			
	0.41	–0.08	0.13	0.45	0.22
	0.16				
	0.03				
				1.65	
	0.99				
	1.81				
	1.24				
	3.58	0.28			2.00
				–0.02	
	–0.24	–0.17		–0.39	

Study	Age[a]	Previous Literacy Skill[b]	Intervention Type[c]	Type of PA Training (Unit)[d]	Type of PA Training (Task)[e]
Chera, P., & Wood, C. (2003). Animated multimedia "talking books" can promote phonological awareness in children beginning to read. *Learning and Instruction, 13*, 33–52.	0	—	5	1	—
Cunningham, A. (1990). Explicit versus implicit instruction in phonemic awareness. *Journal of Experimental Child Psychology, 50*, 429–444.	1	3	1	2	3
Diaz-Guerrero, R., & Holtzman, W. H. (1974). Learning by televised "Plaza Sesamo" in Mexico. *Journal of Educational Psychology, 66*(5), 632–643.	0	—	3	—	—
Fox, B., & Routh, D. K. (1984). Phonemic analysis and synthesis as word attack skills: Revisited. *Journal of Educational Psychology, 76*(6), 1059–1064.	1	2	2	2	3
Fuchs, D., Fuchs, L. S., Thompson, A., Al Otaiba, S., Yen, L., Yang, N. J., et al. (2001). Is reading important in reading readiness programs? A randomized field trial with teachers as program implementers. *Journal of Educational Psychology, 93*(2), 251–267.	1	—	2	1	3
Fuchs, Fuchs, Thompson, Al Otaiba, Yen, Yang, et al. (2001).	1	—	5	1	3
Fuchs, D., Fuchs, L. S., Thompson, A., Al Otaiba, S., Yen, L., Yang, N. J., et al. (2002). Exploring the importance of reading programs for kindergartners with disabilities in mainstream classrooms. *Exceptional Children, 68*(3), 295–311.	1	—	2	3	2
Fuchs, D., Fuchs, L. S., Thompson, A., Al Otaiba, S., Yen, L., Yang, N. J., et al. (2002).	1	—	5	3	2
Goldstein, D. M. (1976). Cognitive-linguistic functioning and learning to read in preschoolers. *Journal of Educational Psychology, 68*(6), 680–688.	0	2	5	2	2
Haddock, M. (1976). Effects of an auditory and an auditory-visual method of blending instruction on the ability of prereaders to decode synthetic words. *Journal of Educational Psychology, 68*(6), 825–831.	0	2	1	—	3
Haddock (1976).	0	2	2	—	3

	ESs for Primary Outcome Variables				
	PA	AK	Oral Language	Reading	Spelling
	0.36			–0.22	
	1.92			0.49	
			0.83		
	0.90				
	1.22			0.49	0.19
	1.50			0.82	0.58
	0.05			–0.50	–0.43
	0.40			0.74	0.11
	1.32				
	1.01				
	1.45				

Study	Age[a]	Previous Literacy Skill[b]	Intervention Type[c]	Type of PA Training (Unit)[d]	Type of PA Training (Task)[e]
Hecht, S. A., & Close, L. (2002). Emergent literacy skills and training time uniquely predict variability in responses to phonemic awareness training in disadvantaged kindergartners. *Journal of Experimental Child Psychology, 82*, 93–115.	1	2	5	2	3
Kjeldsen, A.-C., Niemi, P., & Olofsson, A. (2003). Training phonological awareness in kindergarten level children: Consistency is more important than quantity. *Learning and Instruction, 13*, 349–365.	1	—	2	3	3
Korkman, M., & Peltomaa, A. K. (1993). Preventive treatment of dyslexia by a preschool training program for children with language impairments. *Journal of Clinical Child Psychology, 22*(2), 277–287.	1	—	2	—	—
Lennon, J. E., & Slesinski, C. (1999). Early intervention in reading: Results of a screening and intervention program for kindergarten students. *School Psychology Review, 28*(3), 353–364.	1	—	5	3	3
Lonigan, C. J., Driscoll, K., Phillips, B. M., Cantor, B.G., Anthony., J. L., & Goldstein, H. (2003). A computer-assisted instruction phonological sensitivity program for preschool children at-risk for reading problems. *Journal of Early Intervention, 25*(4), 248–262.	0	—	1	3	3
Lundberg, I., Frost, J., & Peterson, O. (1988). Effects of an extensive program for stimulating phonological awareness in preschool children. *Reading Research Quarterly*, *23*(3), 263–284.	1	—	1	3	3
Lyster, S. H. (2002). The effects of morphological versus phonological awareness training in kindergarten on reading development. *Reading & Writing: An Interdisciplinary Journal, 15*, 261–294.	1	2	2	3	3
Martinussen, R. L., & Kirby, J. R. (1998). Instruction in successive and phonological processing to improve the reading acquisition skills of at-risk kindergarten children. *Developmental Disabilities Bulletin, 26*(2), 19–39.	1	—	2	1	3

	ESs for Primary Outcome Variables				
	PA	AK	Oral Language	Reading	Spelling
	1.13	0.14	0.23	1.09	1.19
	1.60	0.37	–0.10	0.48	
	0.40		0.41	0.78	
	0.90	0.89		0.64	
	0.41				
	0.65	–0.13	0.08		
	0.32		0.46	0.45	0.71
	0.37	0.00		0.20	0.65

Study	Age[a]	Previous Literacy Skill[b]	Intervention Type[c]	Type of PA Training (Unit)[d]	Type of PA Training (Task)[e]
Mioduser, D., Tur-Kaspa, H., & Leitner, I. (2000). The learning value of computer-based instruction of early reading skills. *Journal of Computer Assisted Learning, 16*, 54–63.	1	1	5	1	—
Murray, B. A. (1998). Gaining alphabetic insight: Is phoneme manipulation skill or identity knowledge causal? *Journal of Educational Psychology, 90*(3), 461–475.	1	—	1	—	—
O'Connor, R. E. (1999). Teachers learning ladders to literacy. *Learning Disabilities Research and Practice, 14*(4), 203–214.	1	—	5	1	3
O'Connor, R. E., Jenkins, J. R., Leicester, N., & Slocum, T. A. (1993). Teaching phonological awareness to young children with learning disabilities. *Exceptional Children, 59*(6), 532–546	0	—	1	1	3
O'Connor, R. E., Notari-Syverson, A., & Vadasy, P. (1996). Ladders to literacy: The effects of teacher-led phonological activities for kindergarten children with and without disabilities. *Exceptional Children, 63*(1), 117–130.	1	1	5	1	3
O'Connor, R. E., Notari-Syverson, A., & Vadasy, P. (1998). First-grade effects of teacher-led phonological activities in kindergarten for children with mild disabilities: A follow-up study. *Learning Disabilities Research and Practice, 13*(1), 43–52.	1	—	5	3	3
Oudeans, M. K. (2003). Integration of letter-sound correspondences and phonological awareness skills of blending and segmenting: A pilot study examining the effects of instructional sequence on word reading for kindergarten children with low phonological awareness. *Learning Disability Quarterly, 26*, 258–280.	1	2	2	2	2
Peterson, M. E., & Haines, L. P. (1992). Orthographic analogy training with kindergarten children: Effects on analogy use, phonemic segmentation, and letter-sound knowledge. *Journal of Reading Behavior, 24*(1), 109–127.	1	—	5	1	—

	ESs for Primary Outcome Variables				
	PA	AK	Oral Language	Reading	Spelling
	1.19	2.05		1.90	
	0.06			0.17	
	0.79		1.42	0.58	
	0.72				
	0.76	0.33	0.39	0.99	
	0.25	0.17	0.26	0.80	0.85
	0.32			0.51	
	1.21	0.83		0.74	

Study	Age[a]	Previous Literacy Skill[b]	Intervention Type[c]	Type of PA Training (Unit)[d]	Type of PA Training (Task)[e]
Roberts, T. A. (2003). Effects of alphabet-letter instruction on young children's word recognition. *Journal of Educational Psychology, 95*(1), 41–51.	0	1	2	1	—
Rohrlack, C. R., Bell, B. J., & McLaughlin, T. F. (1982). The value of auditory skills for reading readiness programs. *Educational Research Quarterly, 7*(1), 41–47.	1	—	1	—	2
Saint-Laurent, L., & Giasson, J. (2001). Effects of a multicomponent literacy program and of supplemental phonological sessions on at-risk kindergartners. *Educational Research and Evaluation, 7*(1), 1–33.	1	2	1	3	3
Saint-Laurent & Giasson (2001).	1	2	5	3	3
Schneider, W., Ennemoser, M., Roth, E., & Küspert, P. (1999). Kindergarten prevention of dyslexia: Does training in phonological awareness work for everybody? *Journal of Learning Disabilities, 32*(5), 429–436.	1	3	1	3	3
Schneider, W., Küspert, P., Roth, E., Visé, M., & Marx, H. (1997). Short- and long-term effects of training phonological awareness in kindergarten: Evidence from two German studies. *Journal of Experimental Child Psychology, 66*, 311–340.	1	—	1	—	—
Schneider, Küspert, Roth, Visé, & Marx (1997).	1	—	1	—	—
Schneider, W., Roth, E., & Ennemoser, M. (2000). Training phonological skills and letter knowledge in children at risk for dyslexia: A comparison of three kindergarten intervention programs. *Journal of Educational Psychology, 92*(2), 284–295.	1	—	1	3	1
Schneider, Roth, & Ennemoser (2000).	1	—	2	3	1
Schneider, Roth, & Ennemoser (2000).	1	—	3	3	1
Silva, C., & Alves-Martins, M. (2002). Phonological skills and writing of presyllabic children. *Reading Research Quarterly, 37*(4), 466–483.	1	2	1	1	1
Silva & Alves-Martins (2002).	1	2	5	1	1

	ESs for Primary Outcome Variables				
	PA	AK	Oral Language	Reading	Spelling
	0.55	1.00	–0.41		
	0.16				
	0.25				0.28
	0.34				0.31
	1.04			0.26	0.53
	0.65	0.12		0.21	
	0.70	0.05	0.08	0.05	
	0.77			–0.61	
	–0.17			–0.31	
	0.48			–0.52	
	1.62				
	1.05				

Study	Age[a]	Previous Literacy Skill[b]	Intervention Type[c]	Type of PA Training (Unit)[d]	Type of PA Training (Task)[e]
Silva, C., & Alves Martins, M. (2003). Relations between children's invented spelling and the development of phonological awareness. *Educational Psychology, 23*(1), 3–16.	1	2	5	1	—
Solity, J. (1996). Phonological awareness: Learning disabilities revisited? *Educational and Child Psychology, 13*(3), 103–113.	0	—	1	3	3
Solity (1996).	0	—	2	3	3
Solilty, J., Deavers, R., Kerfoot, S., Crane, G., & Cannon, K. (1999). Raising literacy attainments in the early years: The impact of instructional psychology. *Educational Psychology, 19*(4), 373–397.	0	—	5	—	3
Tangel, D. M., & Blachman, B. A. (1992). Effect of phoneme awareness instruction on kindergarten children's invented spelling. *Journal of Reading Behavior, 24*(2), 233–261.	1	—	2	3	—
Torgesen, J., & Davis, C. (1996). Individual difference variables that predict response to training in phonological awareness. *Journal of Experimental Child Psychology, 63*, 1–21.	1	—	1	3	3
Torgesen, J., Morgan, S. T., & Davis, C. (1992). Effects of two types of phonological awareness training on word learning in kindergarten children. *Journal of Educational Psychology, 84*(3), 364–370.	1	2	1	1	3
Torgesen, J. K., Wagner, R. K., & Rashotte, C. A. (1997). Prevention and remediation of severe reading disabilities: Keeping the end in mind. *Scientific Studies of Reading, 1*(3), 217–234.	1	1	5	2	1
Torgesen, J. K., Wagner, R. K., Rashotte, C. A., Rose, E., Lindamood, P., Conway, T., et al. (1999). Preventing reading failure in young children with phonological processing disabilities: Group and individual responses to instruction. *Journal of Educational Psychology, 91*(4), 579–593.	1		5	2	1
Trout, A. L., Epstein, M. H., Mickelson, W. T., Nelson, J. R., & Lewis, L. M. (2003). Effects of a reading intervention for kindergarten students at risk for emotional disturbance and reading deficits. *Behavioral Disorders, 28*(3), 313–326.	1	—	5	—	2

	ESs for Primary Outcome Variables				
	PA	AK	Oral Language	Reading	Spelling
	1.36				
	0.43			0.50	
	0.68			0.79	
	0.47	0.86		0.62	0.42
	1.76	0.49		0.57	0.93
	0.86				
	1.91	0.18		–1.57	
	0.16			0.50	0.25
				–0.14	
				0.69	

Study	Age[a]	Previous Literacy Skill[b]	Intervention Type[c]	Type of PA Training (Unit)[d]	Type of PA Training (Task)[e]
Ukrainetz, T. A., Cooney, M. H., Dyer, S. K., Kysar, A. J., & Harris, T. J. (2000). An investigation into teaching phonemic awareness through shared reading and writing. *Early Childhood Research Quarterly, 15*(3), 331–355.	1	—	2	1	1
van Daal, V. H. P., & Reitsma, P. (2000). Computer-assisted learning to read and spell: Results from two pilot studies. *Journal of Research in Reading, 23*(2), 181–193.	1	1	5	2	3
Vandervelden, M. C., & Siegel, L. S. (1997). Teaching phonological processing skills in early literacy: A developmental approach. *Learning Disability Quarterly, 20*, 63–81.	1	2	5	3	—
Walton, P. D., Bowden, M. E., Kurtz, S. L., & Angus, M. (2001). Evaluation of a rime-based reading program with Shuswap and Heiltsuk First Nations prereaders. *Reading & Writing: An Interdisciplinary Journal, 4*, 229–264.	1	2	5	3	—
Warrick, N., Rubin, H., & Rowe-Walsh, S. (1993). Phoneme awareness in language-delayed children: Comparative studies and intervention. *Annals of Dyslexia, 43*, 153–173.	1	2	2	3	1
Zevenbergen, A. A., Whitehurst, G. J., & Zevenbergen, J. A. (2003). Effects of a shared-reading intervention on the inclusion of evaluative devices in narratives of children from low-income families. *Applied Developmental Psychology, 24*, 1–15.[f]	0	—	1	—	—

[a] *Age of children in intervention (0 = preschool, 1 = kindergarten).*

[b] *Literacy level of children in intervention (1 = little or no AK and not reader, 2 = moderate to high AK and not reader, 3 = reader).*

[c] *Type of Intervention (1 = PA training only, 2 = PA training and letter-knowledge training, 3 = letter-knowledge training only, 4 = PA training and phonics training).*

[d] *Linguistic unit of analysis used in PA training activity (1 = subphoneme, 2 = phoneme, 3 = both subphoneme and phoneme).*

[e] *Operation or manipulation used in PA training (1 = analysis, 2 = synthesis, 3 = both analysis and synthesis).*

[f] *This study is combined with the original study: Whitehurst, G. J., Epstein, J. N., Angell, A. C., Payne, A. C., Crone, D. A. & Fischel, J. E. (1994). Outcomes of an emergent literacy intervention in Head Start. Journal of Educational Psychology, 86, 542–555.*

	ESs for Primary Outcome Variables				
	PA	AK	Oral Language	Reading	Spelling
	1.04				
				0.42	
	0.69	–0.63		0.52	1.11
	0.59	0.50		0.97	
	0.75				
			0.09		

Chapter 4

IMPACT OF SHARED-READING INTERVENTIONS ON YOUNG CHILDREN'S EARLY LITERACY SKILLS

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Shared-reading practices—a parent reading a picture book with a toddler or a teacher reading a book to a class of preschoolers—are reading practices that are widely recommended to promote language and other skills related to early literacy development. Shared-reading activities are often recommended as the single most important thing adults can do to promote the emergent literacy skills of young children. Scarborough and Dobrich (1994; see also Bus, van Ijzendoorn, & Pellegrini, 1995) provided a summary of studies that examined the effect of shared reading on young children's emergent literacy skills, and their results called into question the positive effects often claimed for reading or sharing picture books with young children.

Accordingly, the National Early Literacy Panel (NELP) examined the effects of interventions that primarily or entirely focused on shared reading. These shared-reading interventions included those that involved parents, teachers, or the combination of parents and teachers implementing some form of shared reading with children individually or in groups. To be included in NELP's analysis, a study that examined the effects of shared reading had to use a group design (randomized control trial [RCT] or quasiexperimental design [QED]) that was not seriously confounded, and it had to evaluate the effectiveness of the intervention with outcome measures of conventional literacy skills (i.e., decoding, reading comprehension, or spelling) or skills that NELP identified as predictors of later conventional literacy skills. The studies also had to have appeared in a refereed journal; they had to include sufficient information to allow an effect size (ES) to be calculated; and those studies that used QEDs had to provide evidence of the group's initial comparability. Nineteen studies on the impacts of shared-reading interventions met these criteria.

The studies included in NELP's analysis of shared-reading interventions differ from those included in the earlier Scarborough and Dobrich (1994) and Bus et al. (1995) reports in a number of ways. NELP's analysis considered only those studies that had undergone some independent scientific review, included studies of both preschool and kindergarten children, and included only studies that evaluated the effects of interventions. NELP subjected the studies to a more rigorous set of screening criteria to increase the likelihood that the effects were causally interpretable, and finally, NELP included studies that had not yet been published at the time of the earlier review.

Children, in most of these studies, were exposed to some kind of a short-term (i.e., one to six months) shared-reading intervention that either represented a substantial increase in frequency of shared-reading activities or a change in the style of shared-reading activities (such as engaging the children actively in telling the story rather than being passive listeners). There were many variations on these procedures, with some delivered by teachers and others by parents. Some studies examined whole-class interventions; one study examined the impact of providing books and information to parents during well-baby pediatrician visits; and two other studies examined the impact of computerized storybook interventions. Children in the comparison groups in these studies usually received less exposure to shared reading than did the children in the experimental group, and the shared reading they did receive rarely involved more than the adult just reading books to children. In most cases, the researcher did not specify or control what the children experienced in the comparison-group condition, meaning that these children's exposures to shared reading were to the usual practices of their teachers or parents. Consequently, these studies provide comparisons of some kind of intensified or improved effort to read to children with the usual kinds of shared reading that children commonly experience.

Overall Estimates of Intervention Impacts

Listed in Table 4.1 are the overall impacts of the shared-book interventions across all of the outcome variables that NELP considered. This table includes, for each outcome variable (presented in alphabetical order), the number of studies that contributed to the ES estimates, an estimate of the ES based on a fixed-effect model, an estimate of the ES based on a random-effect model,[1] the 95 percent upper and lower bounds of the ES based on the random-effect model, and the statistical significance of the ES from the random-effect model. Most of the shared-reading intervention studies measured the impact of the interventions on oral language skills (16 studies). Fewer studies examined the impact of these interventions on phonological awareness (PA) (two studies), general cognitive ability (one study), alphabet knowledge (AK) (two studies), print knowledge (four studies), reading readiness (one study), or writing (one study). No studies in this category of interventions examined the impact of the intervention on memory; rapid automatic naming (RAN), reading, spelling, or visual processing as an outcome variable.

As can be seen in Table 4.1, shared-reading interventions had moderate effects on measures of oral language and print knowledge. The one study with writing as an outcome measure also reported a moderate impact. No other effect was statistically significant or of a size that would

[1] Except where noted, all ES estimates and associated statistics are based on a random-effect model.

be considered substantively important. These studies indicate that shared-reading interventions can have a significant, substantial, and positive impact both on young children's oral language skills and on young children's print knowledge. Shared-reading interventions appear to have no impact on young children's PA skills or their AK; however, there have been too few studies using these—or other—outcome measures to provide a reliable estimated ES.

Table 4.1. Estimates of Effect Sizes Across Outcome Domains for Interventions Involving Shared Reading or Sharing Books with Young Children for Each Dependent Variable

Dependent Variable	Fixed ES	Random ES	95% CI		*N of Studies*	*p* for ES
			Lower Bound	Upper Bound		
AK	–0.06	–0.06	–0.47	0.35	2	0.78
Cognitive ability	0.10	0.10	–0.21	0.41	1	0.52
Oral language	0.66	0.73	0.27	1.20	16	0.002
PA	0.11	0.11	–0.15	0.35	2	0.42
Print knowledge	0.51	0.50	0.28	0.73	4	0.0001
Readiness	–0.14	–0.14	–0.64	0.36	1	0.58
Writing	0.52	0.52	0.23	0.81	1	0.0005

Note: CI = CI for random-effect model.

The largest impact of shared reading was on oral language outcomes, with an average ES of 0.73. This result means that, on average, children who received a shared-reading intervention scored, on oral language, more than 0.7 of a standard deviation higher than children who had not received such instruction. To put this in context, if the average children who were *not* read to in the enhanced format scored 100 on a standardized test of oral language (with a mean of 100 and a standard deviation of 15), then the average children who were read to in these enhanced or extended ways would score 111 on the test (i.e., the difference between scoring at the 77th percentile versus scoring at the 50th percentile).

One study in this set, an examination of the Reach Out and Read (ROR) program, had a large, and perhaps misleading, ES (High, LaGasse, Becker, Ahlgren, & Gardner, 2000). This study was a quasiexperiment that yielded a statistically significant and larger ES than the average of all randomized studies combined. In this study, the researchers did not directly assess student language development but asked parents to estimate their children's vocabulary performance. When one study has such a different result, it is common practice to conduct the analysis again with that outlier excluded. With that study removed from the oral language analysis, the ES estimate shrinks to 0.57, making it smaller but still showing that sharing books with young children has a significant, moderate impact on children's learning. See Table 4.2 for the results of this analysis with the outlier effect removed.

Table 4.2. Effect Sizes for Oral Language Outcomes for Shared-Reading Interventions

Dependent Variable	Fixed ES	Random ES	95% CI		*N of Studies*	*p* for ES
			Lower Bound	Upper Bound		
Oral language with outlier study included	0.66	0.73	0.33	0.60	16	0.002
Oral language with outlier study excluded	0.47	0.57	–0.23	0.90	15	0.001

Note: CI = CI for random-effect model.

Estimates of Intervention Impacts by Characteristics of Interventions and Populations

What kinds of shared-reading experiences have made this difference? In addition to the analyses on the overall effects of shared-reading interventions on children's early literacy and language skills, analyses were conducted to determine what effects variations in implementations had or what kinds of children benefited most from this kind of support. These analyses could be conducted only for outcome variables for which there was a sufficient number of studies to allow estimation of effects by subcategory. For this reason, only studies that measured the impact of shared reading on oral language development could be analyzed. But even with oral language, there were only 16 studies. Consequently, it is likely that not all of the subanalyses reported here reflect independent analyses of separate variables; that is, in some cases, the subdivisions of the various studies overlap with other subdivisions of the studies.

The first subanalysis was conducted to determine whether there were any differences in the ESs based on the type of study design (RCT versus QED). The results of this comparison are shown in Table 4.3. All but one of the studies that included oral language as an outcome variable randomly assigned children to the treatment or control group. The ES estimate for the quasiexperiment was larger than for the other studies ($Q[1, 13] = 16.73$, $p < 0.0001$), suggesting that this study was a relative outlier in terms of the results obtained. Part of the impact identified in that study may have been due to preexisting but unidentified differences between the experimental and control groups.

Table 4.3. Effect Sizes for Oral Language Outcomes for Study Classification Based on Type of Study Design

Study Design	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
RCT	0.56	0.15	0.26	0.86	3.65	15	0.003
QED	2.87	0.54	1.80	3.93	5.29	1	0.0002

NELP's analysis of predictors of conventional forms of reading and writing growth revealed that some oral language skills were better predictors of later reading outcomes than were others.

Specifically, measures of more complex oral language skills (such as grammar, the ability to define vocabulary, and listening comprehension) and composite measures that included these skills were stronger predictors of later reading achievement than were measures of simple vocabulary. For this reason, the panel considered whether there was a different impact of shared-reading interventions on composite measures of oral language than on measures of simple vocabulary. The results of this analysis, with the one outlier study excluded, are shown in Table 4.4. Although the ES estimate for measures of simple vocabulary was almost twice that for composite measures of oral language, this difference was not statistically reliable, meaning that it cannot be said with certainty that there was a difference. With the ROR study included, the average ES for vocabulary was 0.84, but the differences between effects on vocabulary and composite measures of oral language still were not statistically significant.

Table 4.4. Effect Sizes of Shared-Reading Interventions on Measures of Simple Vocabulary and Composite Measures of Oral Language, Excluding Study on Reach Out and Read

Outcome Measure	Mean ES	SE	95% CI		t	*n*	*p*
			Lower Bound	Upper Bound			
Vocabulary	0.60	0.23	0.16	1.05	2.65	9	0.008
Composite oral language	0.35	0.28	–0.20	0.89	1.26	5	0.21

Analysis of Intervention Effects by Age and Risk Status of Children

Studies involving the impacts of shared-reading interventions included a broad age range of children, ranging from studies involving two-year-olds to studies involving kindergarten-age children. The impact of shared-reading interventions may differ for younger and older children for developmental or experiential reasons. To examine whether shared-reading interventions had different effects on children at different age levels, where possible, studies were divided into two groups. One group of studies focused on children who were not yet in kindergarten, and the other studies focused on children who were in kindergarten. Studies that combined children from the two age groups were excluded from these analyses. Estimates of the impact of shared-reading interventions for preschool-age or younger children and kindergarten-age children are shown in Table 4.5. There was no statistically significant difference in the ES estimates for older versus younger children on oral language outcomes ($Q[1, 13] = 0.10$, $p = 0.86$). Shared-reading interventions were equally effective with children across these age ranges.

Table 4.5. Effect Sizes for Oral Language Outcomes for Study Classification Based on Ages of Children in Sample

Child Age Group	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Prekindergarten	0.75	0.24	0.29	1.22	3.15	13	0.0008
Kindergarten	0.66	0.46	–0.25	1.57	1.43	3	0.18

To examine whether shared-reading interventions had smaller or larger effects for children based on their risk status, studies were divided on the basis of whether the majority of the children in a study were at risk. Classification of studies were done either using the study authors' classification of the study sample or based on the description of the study sample (e.g., children attending Head Start were classified as at risk because they are growing up in poverty). Studies with combined samples across this dimension (i.e., children both at risk and not at risk included in the study sample) were not included in this analysis. Estimates of the impact of shared-reading interventions for children at risk and those not at risk are shown in Table 4.6. There appeared to be a larger effect for studies that focused on children who were not at risk, but the difference in the ES estimates was not statistically reliable ($Q[1, 13] = 0.56$, $p = 0.45$), and the confidence intervals (CIs) overlapped substantially.

Table 4.6. Effect Sizes for Oral Language Outcomes for Study Classification Based on Risk Status of Children in Sample

Child Risk Status	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
At risk	0.47	0.40	–0.31	1.26	1.19	12	0.26
Not at risk	0.82	0.25	0.35	1.31	3.37	4	0.005

Analysis of Intervention Effects by Characteristics of Shared-Reading Intervention

The shared-reading interventions that were considered in these studies differed in the degree to which they were interactive. One common form of interactive shared reading is known as dialogic reading (DR). In DR, the adult reader asks the child or children questions about the story or the pictures in the book and provides feedback to the child or children in the form of repetitions, expansions, and modeling of answers. In DR, the adult tries to facilitate the child's active role in telling the story rather than foster passive listening. Studies were separated based on whether the reading was interactive like DR. Results for this analysis are shown in Table 4.7.

Table 4.7. Effect Sizes for Oral Language Outcomes for Study Classification Based on Type of Shared Reading Used in Intervention

Type of Reading	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Dialogic	0.60	0.27	0.06	1.14	2.18	9	0.05
Not dialogic	0.78	0.31	0.18	1.38	2.56	7	0.02

As noted in Table 4.7, the ES estimates for both DR interventions and non-DR–style interventions were moderately sized and statistically significant. The ES estimate for non-DR interventions was slightly higher than that for DR interventions; however, this difference was not statistically reliable ($Q[1, 14] = 0.20$, $p = 0.65$). The noninteractive shared-reading interventions,

lacking the guidance and support of the more thoroughly structured DR interventions, were effective; however, this was due, in part, to a large ES for the outlier study (High et al., 2000). Consequently, the analysis reported in Table 4.7 was conducted again, this time with the ROR study excluded. The results of this analysis are shown in Table 4.8. The removal of the ROR study decreased the ES estimate for non-DR studies from 0.78 to 0.42 and rendered this finding nonsignificant (meaning that the groups in the noninteractive approaches did not actually do statistically better than the control groups when the ROR study was removed from this analysis). Even with this adjustment, however, the difference in ES estimates for studies using DR and those not using DR was not statistically reliable ($Q[1, 13] = 0.36$, $p = 0.55$).

Table 4.8. Effect Sizes for Oral Language Outcomes for Study Classification Based on Type of Shared Reading Used in Intervention, Excluding Study on Reach Out and Read

Type of Reading	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Dialogic	0.59	0.20	0.20	0.98	2.99	9	0.01
Not dialogic	0.41	0.24	–0.06	0.87	1.72	6	0.11

Children's early childhood education teachers, children's parents, and combinations of teachers and parents have conducted shared-reading interventions. Table 4.9 lists the ES estimates from interventions in which teachers, parents, or both teachers and parents provided the shared-reading intervention (or the computerized intervention was used). There was no statistically reliable difference in ESs depending on how the shared reading was delivered ($Q[3, 12] = 0.16$, $p = 0.16$). Comparison of the studies involving parents reading to their children and studies involving both parents and teachers doing the reading did not have statistically reliable differences in ESs (the CIs overlap). When the ROR study (involving parent reading) was excluded from the analysis, the estimated ES for parent-provided reading was reduced to 0.57 ($p = 0.16$).

Table 4.9. Effect Sizes for Oral Language Outcomes for Study Classification Based on Agent of Intervention

Agent of Intervention	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Parent	1.35	0.40	0.56	2.14	3.36	3	0.006
Teacher	0.84	0.32	0.21	2.60	2.60	5	0.023
Parent and teacher	0.29	0.30	–0.29	0.88	0.99	6	0.34
Computer	0.36	0.50	0.61	1.34	0.73	2	0.48

Other aspects of the shared-reading interventions were coded to identify possible moderators of the effectiveness of shared-reading interventions. In some studies, books were provided as a part of the intervention to support the shared-reading effort. Estimates for ESs depending on whether books were provided are shown in Table 4.10. If books were provided as a part of the intervention, the estimated ES was 0.78, but this dropped to 0.50 with the ROR study

eliminated. If books were not provided as a part of the intervention, the estimated ES was 0.55, but the difference between ESs with (Q[1, 14] = 0.31, p = 0.58) or without (Q[1, 13] = 0.02, p = 0.88) the ROR study was not statistically reliable.

Table 4.10. Effect Sizes for Oral Language Outcomes for Study Classification Based on Whether Books Were Provided as a Part of the Intervention

Books Provided	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
No	0.55	0.31	–0.05	1.15	1.80	7	0.09
Yes	0.78	0.27	0.25	1.31	2.88	9	0.01

Only five studies reported the amount of training provided to parents or teachers for the shared-reading intervention. The amount of training reported in these studies ranged from 50 to 180 minutes. Analyses of these five studies revealed that there was no significant relationship between amounts of training provided and the ES estimate for those studies (β = 0.61, p = 0.32). Nine studies reported the approximate total amount of time that children were exposed to the shared-reading interventions. Reports of amount of reading in these studies ranged from 112 to 1,500 minutes. There was no relationship between the amount of reading and variation in ES (β = –0.01, p = 0.98).

Analysis of Intervention Effects by Demographics of Study Samples

NELP considered whether there were different impacts for shared-reading efforts with children from different demographic groups, including socioeconomic status (SES), ethnicity, and the population density of the location where the study was conducted (i.e., rural, urban, suburban, mixed, unknown). In the majority of studies, either these demographic characteristics were not reported or the studies examined samples of children with mixed demographic characteristics.

Results of the subanalyses of the impact of SES level in shared-reading interventions are shown in Table 4.11. ES estimates for oral language outcomes did not vary significantly as a result of children's economic status (Q[2, 9] = 0.23, p = 0.89). Most studies that could be coded for SES included children from low-SES backgrounds, and there were too few studies with children from other economic levels to generate reliable ES estimates. Notably, the 9 studies involving only children from low-SES backgrounds produced a large and statistically significant ES estimate of 0.79.

Results of the ethnicity subanalysis are shown in Table 4.12. There was no statistically reliable difference in ESs associated with ethnicity (Q[3, 11] = 0.28, p = 0.96). However, there were only single instances of shared-reading interventions aimed at samples that were majority Caucasian or that were majority Hispanic or Latino. Consequently, there were too few studies with these ethnic classifications from which to generate reliable ES estimates. Three studies of shared-reading interventions were conducted with children who were majority African American. The remaining 10 studies were conducted with children with diverse or unspecified

ethnic classification. CIs for studies involving either African American or mixed or unknown populations overlapped substantially. Consequently, there was no evidence that ethnicity moderated the impacts of shared-reading interventions.

Table 4.11. Effect Sizes for Oral Language Outcome for Shared-Reading Study Classification Based on Socioeconomic Status of Study Sample

SES	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Low	0.79	0.27	0.25	1.32	2.89	9	0.02
Not low	0.85	0.59	–0.31	2.01	1.44	2	0.18
Mixed	0.41	0.79	–1.12	1.95	0.52	1	0.61

Table 4.12. Effect Sizes for Oral Language Outcome for Shared-Reading Study Classification Based on Ethnicity of Study Sample

Ethnicity	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Caucasian	0.41	0.77	–1.13	1.95	0.52	1	0.61
African American	0.70	0.47	–0.22	1.63	1.49	3	0.17
Hispanic or Latino	1.02	0.90	–0.74	2.79	1.14	1	0.28
Mixed or unknown	0.75	0.26	0.25	1.26	2.93	10	0.014

Results of the analysis based on population density are shown in Table 4.13. There was no statistically reliable difference in ESs associated with population density ($Q[3, 11] = 3.67$, $p = 0.30$). The samples from the majority of studies were coded as unknown or urban population densities. There were too few instances of rural or suburban population density to generate reliable ES estimates. However, the CIs for the studies classified as urban or unknown overlapped. Therefore, there was no evidence that population density moderated the impact of shared-reading interventions.

Table 4.13. Effect Sizes for Oral Language Outcome for Shared-Reading Study Classification Based on Population Density of Study Sample

Population Density	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Rural	–0.12	0.69	–1.47	1.24	–0.17	1	0.87
Urban	1.05	0.28	0.51	1.59	3.83	7	0.003
Mixed	0.96	0.78	–0.56	2.49	1.24	1	0.24
Unknown	0.47	0.31	–0.13	1.10	1.55	6	0.15

Summary and Conclusions

Results from this meta-analysis of the impacts of shared-reading interventions on the early literacy skills of young children indicated that these interventions yielded moderate effects on oral language skills and print knowledge. For oral language skills, these effects were robust across variations in the type of shared-reading intervention and the children's ages or their risk status. Although it is possible that shared reading could affect other aspects of children's literacy and language development, only four studies even included print knowledge as an outcome variable, and even fewer studies included any other variable. Therefore, it was not possible to determine whether there were other benefits of shared reading. Also, at this time, there are few studies that allow fine-grained analysis of the impact of population variables, such as SES, ethnicity, or population density. Given the lack of evidence that sample characteristics moderate the effects of shared-reading interventions, along with the inclusion of diverse samples in the existing studies and the consistency of results across studies, it seems reasonable at this time to make such interventions available to a broad range of children.

Given the ubiquity of both the practice of and the recommendation for shared reading in early childhood education settings, it is somewhat surprising that more studies have not investigated the impact of these practices. Although it is clear that shared reading improves oral language skills and print knowledge, there is not yet evidence that shared reading promotes the development of other emergent literacy skills, and there is no evidence that shared reading promotes any improvement in conventional literacy skills. Although it is often claimed that reading to children improves their reading ability, too few studies have been conducted with emergent literacy outcome measures (such as PA, AK, readiness, and writing) or conventional literacy outcome measures (such as decoding, reading comprehension, or spelling) to provide statistically reliable evidence that shared reading improves such skills (and, if so, which ones). Given these important gaps in what is known about the effectiveness of shared reading, it seems prudent to conclude that shared reading alone would not be a sufficient response to the literacy learning needs of young children. This would be particularly true for those at risk or who show weaknesses in those specific emergent literacy skills that have not been shown to improve due to reading to children (such as PA or AK).

Based on available studies, it appears that shared-reading interventions are equally effective for children who are at risk of later academic difficulties and for children who are not at risk. Also, shared-reading interventions appear to be equally effective for older and younger children. Perhaps direct study of these variations would permit a more definitive answer concerning their influence. Given the existing pattern of results, it seems reasonable to conclude that shared reading is appropriate and useful for a very diverse group of young children.

It is important to note, however, that, because of the limited number of studies available, our understanding of the impact of age, risk status, and agent of intervention is inadequate. This is partly due to the lack of studies reporting data in ways that allow these comparisons to be made and partly because the various moderators are confounded in the existing studies. For instance, most DR studies with younger children used parents as the agents of intervention and were conducted with middle- to upper-income families (e.g., Arnold et al., 1994; Huebner, 2000; Whitehurst et al., 1988). Most DR studies with older children were conducted using

teachers as the agents of intervention (i.e., in preschool or child-care settings) with children from low-income families (e.g., Lonigan & Whitehurst, 1998; Whitehurst, Arnold, et al., 1994; Whitehurst, Epstein, et al., 1994). Therefore, for meta-analysis, no one of these moderators can be separated from the other moderators. Likewise, analyses of duration of the interventions are confounded with age, agents of intervention, and risk status of the children. Therefore, it is not possible to examine combinations of these potential moderators with currently existing studies (e.g., the impact of parents using a shared-reading intervention for younger, at-risk children).

Despite any analytical limitations, these studies indicate that shared-reading interventions provide early childhood educators and parents with a useful method for successfully stimulating the development of young children's oral language skills. For some reason, the impact of shared-reading interventions is larger for vocabulary outcomes than for more complex aspects of oral language (such as grammar, narrative understanding, or listening comprehension) or broader measures of oral language that include aspects of both vocabulary and more complex oral language skills. Whether this is due to real differences in outcomes or to the nature of the shared-reading interventions that have been studied and the outcome measures used so far is as yet unknown. Additional research will be needed to better explain this finding.

Future research needs to examine the types of shared-reading interventions that have been studied and how these interventions have been delivered. Interventions that used an interactive style of shared reading, such as DR, produced larger effects on children's oral language outcomes than did noninteractive interventions, but these differences did not reach statistical significance. However, only studies using DR resulted in an average ES that was statistically significant. Direct studies of the contrast between interactive shared reading and noninteractive shared reading (e.g., see Lonigan et al., 1999) could help to clarify the meaning of this difference. For the existing studies, there were no significant differences in outcomes due to who delivered the shared-reading interventions, whether books were provided as part of the intervention, or how much the adults read to the children. It is important to note that statistical significance is not the only issue of importance in the context of a meta-analysis. Statistical significance—that is, the determination that an effect is sizable enough that it would unlikely have occurred by chance or normal variation—is affected by both the size of a difference and the number of observations (in the case of meta-analysis, the number of studies). The sizes of the differences found here for DR, agent delivering the intervention, amount of reading, and book availability were large enough to be of educational importance but were simply not found across a sufficiently large sample of studies to achieve statistical significance.

For studies conducted in preschool or kindergarten classes, the teacher or other adult most often read to children in small groups. Notably, the estimated ESs for shared reading do not reflect the impact of the typical program of shared reading conducted in early childhood settings (e.g., whole-group shared reading during circle time), which was typically the comparison condition in studies of shared reading in schools. Consequently, the results of this analysis do not provide evidence that typical early childhood education classroom practices promote the development of oral language and print knowledge skills.

Overall, the evidence supports the positive impact of shared-reading interventions that are more intensive in frequency and interactive in style on the oral language and print knowledge skills of

young children. At present, the number of studies in the literature that have examined specific groups of children (such as children from different SES backgrounds, different ethnicities, home languages, or living circumstances—i.e., rural versus urban) is not sufficient to allow an adequate analysis of how shared-reading interventions may result in larger or smaller effects on these groups. It seems reasonable to proceed with the idea that shared reading would help all or most subgroups of children, given the inclusion in these studies of mixed samples of children from different socioeconomic backgrounds, different ethnicities, and different living circumstances. Although the early childhood education field is interested in specific questions about successful interventions for children of low-income families, children from traditionally underrepresented ethnic groups, children who are English-language learners, or children growing up in rural or urban environments, studies focusing on shared reading with these groups have not yet been reported in sufficient frequency to allow definitive answers to these questions. Nevertheless, the existing studies provide no reason to expect substantially different patterns of results for these variables in future research.

Research Studies Synthesized in the Analysis of Shared-Reading Interventions

Arnold, D. H., Lonigan, C. J., Whitehurst, G. J., and Epstein, J. N. (1994). Accelerating language development through picture book reading: Replication and extension to a videotape training format. *Journal of Educational Psychology, 86*(2), 235–243.

Crain-Thoreson, C., and Dale, P. S. (1999). Enhancing linguistic performance: Parents and teachers as book reading partners for children with language delays. *Topics in Early Childhood Special Education, 19*(1), 28–39.

High, P. C., LaGasse, L., Becker, S., Ahlgren, I., & Gardner, A. (2000). Literacy promotion in primary care pediatrics: Can we make a difference? *Pediatrics, 105*(4), 927–934.

Huebner, C. E. (2000). Promoting toddlers' language through community-based intervention. *Journal of Applied Developmental Psychology, 21*(5), 513–535.

Johnston, C. B. (1997). Interactive storybook software: Effects on verbal development in kindergarten children. *Early Child Development and Care, 132,* 33–44.

Justice, L. M., and Ezell, H. K. (2000). Enhancing children's print and word awareness through home-based parent intervention. *American Journal of Speech-Language Pathology, 9*(3), 257–269.

Justice, L. M., and Ezell, H. K. (2002). Use of storybook reading to increase print awareness in at-risk children. *American Journal of Speech-Language Pathology, 11*(1), 17–29.

Lonigan, C. J., Anthony, J. L., Bloomfield, B. G., Dyer, S. M., and Samwel, C. S. (1999). Effects of two shared-reading interventions on emergent literacy skills of at-risk preschoolers. *Journal of Early Intervention, 22*(4), 306–322.

Lonigan, C. J., & Whitehurst, G. J. (1998). Relative efficacy of parent and teacher involvement in a shared-reading intervention for preschool children from low-income backgrounds. *Early Childhood Research Quarterly, 13*(2), 263–290.

Morrow, L. M., O'Connor, E. M., & Smith, J. K. (1990). Effects of a story reading program on the literacy development of at-risk kindergarten children. *Journal of Reading Behavior, 22*(3), 255–275.

Phillips, L. M., Norris, S. P., Mason, J. M. & Kerr, B. M. (1990). Effect of early literacy intervention on kindergarten achievement. *National Reading Conference Yearbook, 39*, 199–207.

Talley, S., Lancy, D. F., & Lee, T. R. (1997). Children, storybooks, and computers. *Reading Horizons, 38*(2), 117–128.

Valdez-Menchaca, M. C., & Whitehurst, G. J. (1992). Accelerating language development through picture book reading: A systematic extension to Mexican day care. *Developmental Psychology, 28*(6), 1106–1114.

Wasik, B. A., & Bond, M. A. (2001). Beyond the pages of a book: Interactive book reading and language development in preschool classrooms. *Journal of Educational Psychology, 93*(2), 243–250.

Whitehurst, G. J., Arnold, D. S., Epstein, J. N., Angell, A. L., Smith, M., & Fischel, J. E. (1994). A picture book reading intervention in day care and home for children from low-income families. *Developmental Psychology, 30*(5), 679–689.

Whitehurst, G. J. Epstein, J. N, Angell A. L., Payne, A. C., Crone, D. A., & Fischel, J. E. (1994). Outcomes of an emergent literacy intervention in Head Start. *Journal of Educational Research to Journal of Educational Psychology, 86*(4), 542–555.

Whitehurst, G. J., Falco, F. L., Lonigan, C. J., Fischel, J. E., DeBaryshe, B. D., Valdez-Menchaca, M. C., & Caulfield, M. (1988). Accelerating language development through picture book reading. *Developmental Psychology, 24*(4), 552–559.

Whitehurst, G., Zevenbergen, A., Crone, D., Schultz, M., Velting, O., & Fischel, J. (1999). Outcomes of an emergent literacy intervention from Head Start through second grade. *Journal of Educational Psychology, 91*(2), 261–272.

Zevenbergen, A. A., Whitehurst, G. J., & Zevenbergen, J. A. (2003). Effects of a shared-reading intervention on the inclusion of evaluative devices in narratives of children from low-income families. *Journal of Applied Developmental Psychology, 24*(1), 1–15.

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Arnold, D. H., Lonigan, C. J., Whitehurst, G. J., & Epstein, J. N. (1994). Accelerating language development through picture book reading: Replication and extension to a videotape training format. *Journal of Educational Psychology*, *86*(2), 235–243.

Bus, A. G., van Ijzendoorn, M. H., & Pellegrini, A. D. (1995). Joint book reading makes for success in learning to read: A meta-analysis on intergenerational transmission of literacy. *Review of Educational Research*, *65*, 1–21.

High, P. C., LaGasse, L., Becker, S., Ahlgren, I., & Gardner, A. (2000). Literacy promotion in primary care pediatrics: Can we make a difference? *Pediatrics*, *105*, 927–934.

Huebner, C. E. (2000). Promoting toddlers' language through community-based intervention. *Journal of Applied Developmental Psychology*, *21*(5), 513–535.

Lonigan, C. J., Anthony, J. L., Bloomfield, B. G., Dyer, S. M., & Samwel, C. (1999). Effects of two shared-reading interventions on emergent literacy skills of at-risk preschoolers. *Journal of Early Intervention*, *22*(4), 306–322.

Lonigan, C. J., & Whitehurst, G. J. (1998). Relative efficacy of parent and teacher involvement in a shared-reading intervention for preschool children from low-income backgrounds. *Early Childhood Research Quarterly, 13*(2), 263–290.

Scarborough, H. S., and Dobrich, W. (1994). On the efficacy of reading to preschoolers. *Developmental Review*, *14*, 245–302.

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Whitehurst, G. J., Epstein, J. N., Angell, A. L., Payne, A. C., Crone, D. A., & Fischel, J. E. (1994). Outcomes of an emergent literacy intervention in Head Start. *Journal of Educational Psychology*, *86*(4), 542–555.

Whitehurst, G. J., Falco, F. L., Lonigan, C. J., Fischel, J. E., DeBaryshe, B. D., Valdez-Menchaca, M. C., & Caulfield, M. (1988). Accelerating language development through picture book reading. *Development Psychology*, *24*(4), 552–559.

Appendix 4.A. Primary Coding of Studies with Oral Language Outcome Measures

Study	Type of Study[a]	Age[b]	DR or Not DR[c]	Risk Status[d]
Ahlgren, I., Becker, S., Gardner, A., High, P. C., & LaGasse, L. (2000). Literacy promotion in primary care pediatrics: Can we make a difference? *Pediatrics, 105*(4), 927–934.	2	1	0	1
Arnold, D. H., Epstein, J. N., Lonigan, C. J., & Whitehurst, G. J. (1994). Accelerating language development through picture book reading: Replication and extension to a videotape training format. *Journal of Educational Psychology, 86*(2), 235–243.	1	1	1	0
Crain-Thoreson, C., & Dale, P. S. (1999). Enhancing linguistic performance: Parents and teachers as book reading partners for children with language delays, *Topics in Early Childhood Special Education*, *19*(1), 28–40.	1	1	1	1
Huebner, C. E. (2000). Promoting toddlers' language development through community-based intervention. *Journal of Applied Developmental Psychology, 21*(5), 513–535.	1	1	1	0
Johnston, C. B. (1997). Interactive storybook software: Effects on verbal development in kindergarten children. *Early Child Development and Care, 132*, 33–44.	1	2	0	1
Kerr, B. M., Mason, J. M., Norris, S. P., & Phillips, L. M. (1990). Effect of early literacy intervention on kindergarten achievement. *National Reading Conference Yearbook, 39*, 199–207.	1	2	0	0
Lonigan, C. J., Anthony, J. L., Bloomfield, B. G., Dyer, S. M., & Samwel, C. S. (1999). Effects of two shared-reading interventions on emergent literacy skills of at-risk preschoolers. *Journal of Early Intervention, 22*(4), 306–322.	1	1	0	1
Lonigan, Anthony, Bloomfield, Dyer, & Samwel (1999).	1	1	1	1
Lonigan, C. J. & Whitehurst, G. J. (1998). Relative efficacy of parent and teacher involvement in a shared-reading intervention for preschool children form low-income backgrounds. *Early Childhood Research Quarterly, 13*(2), 263–290.	1	1	0	1
Morrow, L. M., O'Connor, E. M., & Smith, J. K. (1990). Effects of a story reading program on the literacy development of at-risk kindergarten children. *Journal of Reading Behavior, 22*(3), 255–275.	1	2	0	1
Talley, S., Lancey, D. F., & Lee, T. R. (1997). Children, storybooks, and computers. *Reading Horizons, 38*(2), 117–128.	1	1	0	1

Oral Language[e]	SES[f]	Ethnicity[g]	Population Density[h]	Mean ES
1	1	4	2	2.87
1	2	4	5	0.75
1	—	4	5	0.29
1	3	1	2	0.41
—	1	4	5	-.49
2	—	4	1	–0.12
1	1	2	2	–0.14
2	1	2	2	–0.03
1	1	2	2	0.43
2	—	4	2	1.70
2	1	4	5	0.24

Study	Type of Study[a]	Age[b]	DR or Not DR[c]	Risk Status[d]
Valdez-Menchaca, M. C., & Whitehurst, G. J. (1992). Accelerating language development through picture book reading: A systematic extension to Mexican day care. *Developmental Psychology, 28*(6), 1106–1114.	1	1	1	1
Wasik, B. A., & Bond, M. A. (2001). Beyond the pages of a book: Interactive book reading and language development in preschool classrooms. *Journal of Educational Psychology, 93*(2), 243–250.	1	1	1	1
Whitehurst, G. J., Arnold, D. S., Epstein, J. N., Angell, A. L., Smith, M., & Fischel, J. E. (1994). A picture book reading intervention in day care and home for children from low-income families. *Developmental Psychology, 30*(5), 679–689.	1	1	1	1
Whitehurst, G. J., Falco, F. L., Lonigan, C. J., Fischel, J. E., DeBaryshe, B. D., Valdez-Menchaca, M.C., et al. (1988). Accelerating language development through picture book reading. *Developmental Psychology, 24*(4), 552–559.	1	1	1	0
Whitehurst, G. J., Zevenbergen, A. A., & Zevenbergen, J. A. (2003). Effects of a shared-reading intervention on the inclusion of evaluative devices in narratives of children from low-income families. *Applied Developmental Psychology, 24*(1), 1–15.	1	1	1	1

[a] *RCT = 1, QED = 2.*

[b] *Preschool or younger = 1, kindergarten = 2.*

[c] *DR = 1, Not DR = 0.*

[d] *At risk = 1, not at risk = 0.*

[e] *Vocabulary = 1, composite measure = 2.*

[f] *Low SES = 1, Not low SES = 2.*

[g] *Ethnicity (1 = Caucasian, 2 = African American, 3 = Hispanic or Latino, 4 = mixed or unknown).*

[h] *Population density (1 = rural, 2 = urban, 3 = suburban, 4 = mixed, 5 = unknown).*

Oral Language[e]	SES[f]	Ethnicity[g]	Population Density[h]	Mean ES
1	1	3	5	1.02
1	1	2	2	1.69
1	1	4	2	0.18
1	2	4	3	0.96
2	1	4	5	0.18

Chapter 5

IMPACT OF HOME AND PARENT PROGRAMS ON YOUNG CHILDREN'S EARLY LITERACY SKILLS

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Some intervention studies that the National Early Literacy Panel (NELP) examined focused on the evaluation of parent and home programs that were aimed at improving young children's preliteracy and literacy skill development. Findings from descriptive and correlational research studies have often been interpreted as demonstrating a link between supportive parental involvement (PI) and children's early literacy-related development. For instance, some research studies (e.g., Hart & Risley, 1995; Snow, Barnes, Chandler, Goodman, & Hemphill, 1991) suggest that children from homes in which parents engage them in elaborated conversations, model the uses of literacy, and engage them in activities that promote basic understandings about literacy (e.g., shared book reading) will have better-developed language and literacy skills (including the kinds of predictor skills identified in Chapter Two of this report) than will children from homes in which these activities are less frequent. Several national efforts, such as Reading Is Fundamental and Reach Out and Read, have focused on getting books into the hands of parents and children and promoting regular parent-child book reading. These and other efforts have worked to some extent, as shown in national surveys indicating an increase in parent-child literacy activities among families with preschoolers (Tabors, Snow, & Dickinson, 2001).

Some educators consider parent education an integral component of early childhood programs; however, reports of their effectiveness have varied widely. Many of the studies reviewed in this chapter were initiated with the assumption that successful PI programs help parents understand the importance of their role as first teachers and equip them with both the skills and the strategies to foster their children's language and literacy development. The purpose of this

research summary was to determine the extent to which these interventions that used parents, typically mothers, as the primary agent of intervention actually confer a benefit to the children in terms of their literacy development.

As previously described, to be included in NELP's analyses of intervention effects, studies need to (1) use a group-comparison design (randomized control trial [RCT] or quasiexperimental design [QED]), (2) use outcome measures that were either assessments of a conventional literacy skill (i.e., decoding, reading comprehension, spelling) or assessments of one of the skills identified as a predictor of later literacy skills by NELP's analyses of predictive studies, and (3) report sufficient information to allow an effect size (ES) to be calculated. Additionally, studies that used a QED were required to have evidence of initial group comparability (i.e., the groups had pretest scores within 0.5 standard deviation of each other). A total of 23 studies were identified that met these criteria and that examined the impacts of home and parent early literacy programs.

Overall Estimates of Intervention Impacts

Across NELP's analyses of intervention effects, nine categories of dependent variables were considered. The results related to the overall impacts of this group of intervention studies across all outcome variables are presented in Table 5.1. The data reported in the table include the outcome variables presented in alphabetical order, the numbers of studies that contributed to the effect estimates, an estimate of each ES based on a fixed-effect model, an estimate of each ES based on a random-effect model,[1] the 95 percent upper and lower bounds of the ESs based on the random-effect model, and the statistical significance of the ESs from the random-effect model. Most of the studies in this category examined the impacts of the interventions on outcome variables reflecting oral language skills (18 studies) or general cognitive ability (six studies; included because of its relationship to IQ, which was one of the predictor variables identified in the earlier analysis). For eight of the other 10 categories of outcome variables, only one or two studies included outcomes for the variable. No study examined the impact of home or parent programs on rapid naming or on visual processing as outcome variables.

As can be seen in Table 5.1, home and parent programs had statistically significant effects on measures of oral language (small) and cognitive ability (moderate to large). There were two other statistically significant effects of home and parent programs (i.e., memory, writing); however, each of these effects was based on a single study, which represents too few studies to allow unambiguous interpretation. Examination of the confidence intervals (CIs) for the oral language and cognitive ability ES estimates shows that they were overlapping. Hence, the effects of home and parent programs were statistically equivalent on these two outcomes. Overall, the results reported in Table 5.1 indicate that home and parent intervention programs included in these studies had a statistically significant and positive impact both on young children's oral language skills and general cognitive abilities.

[1] Except where noted, all ES estimates and associated statistics are based on a random-effect model.

Table 5.1. Estimates of Effect Sizes Across Outcomes for Home and Parent Literacy Programs for Each Dependent Variable

Dependent Variable	Fixed ES	Random ES	95% CI		*N* of Studies	*p* for ES
			Lower Bound	Upper Bound		
AK	–0.03	–0.03	–0.31	0.24	1	0.81
Cognitive ability	0.65	0.92	0.22	1.62	6	0.01
Memory	1.17	1.17	0.50	1.84	1	0.0006
Oral language	0.28	0.37	0.18	0.55	18	0.0001
PA	0.22	0.21	–0.12	0.54	2	0.21
Reading	0.28	0.28	–0.12	0.68	1	0.17
Reading readiness	–0.05	0.05	–0.33	0.22	1	0.71
Spelling	0.09	0.09	–0.18	0.37	1	0.51
Writing	0.52	0.52	0.23	0.81	1	0.0005

Note: CI = CI for random-effect model.

Estimates of Intervention Impacts by Characteristics of Interventions and Populations

In addition to the analyses of the overall effects of home and parent programs on children's literacy development, analyses were conducted that addressed questions about the effects of different features of the programs and how these home and parent programs differed in their impacts on children's skills across different population characteristics of the samples included in the studies. These estimations of effects by characteristics of the intervention or the population could be conducted only in cases in which sufficient numbers of studies used a specific outcome measure. Given that these subanalyses involved two or more categories, only studies that included oral language as an outcome measure could be included in these analyses, to maximize the likelihood that each subcategory would have sufficient studies (i.e., three or more) to allow interpretation. With only six studies that examined outcomes in the cognitive ability domain, the likelihood that divisions of these studies would yield three studies per category or that the classifications of studies would be independent of each other was low.

The first subanalysis was conducted to determine whether there were any differences in ES estimates based on the type of study design (RCT versus QED). The results of the analysis for oral language outcomes are shown in Table 5.2. Although there was a trend for studies using a nonrandomized study design to produce larger results than did experiments, this result was not statistically reliable ($Q[1, 16] = 1.82$, $p = 0.18$).

NELP's analysis of predictors of conventional forms of reading and writing growth revealed that some oral language skills were better predictors of later reading outcomes than others. Specifically, measures of more complex oral language skills (such as grammar, the ability to define words, and listening comprehension) and composite measures that included these skills were stronger predictors of later reading skills than were measures of simple vocabulary. For this reason, the panel considered whether there was a different impact of home and parent programs

on composite measures of oral language from that on measures of simple vocabulary. The results of this analysis are shown in Table 5.3. Although the ES estimate for measures of simple vocabulary was larger than that for composite measures of oral language, this difference was not statistically reliable. The CIs for the ES estimates overlapped.

Table 5.2. Impact of Home and Parent Programs on Oral Language Outcome by Nature of Intervention in Study

Design of Study	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
RCT	0.28	0.10	0.09	0.46	2.85	13	0.012
QED	0.51	0.14	0.23	0.79	3.54	5	0.003

Note: ESs based on random-effect model.

Table 5.3. Effect Sizes of Home and Parent Programs on Measures of Simple Vocabulary and Composite Measures of Oral Language

Measure	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Vocabulary	0.41	0.15	0.13	0.70	2.81	8	0.005
Composite	0.27	0.16	–0.04	0.58	1.72	6	0.086

Note: ESs based on random-effect model.

Analysis of Intervention Effects by Ages of Children

The studies involving the impacts of home and parent intervention programs could have included a broad age range of children. In fact, only one study included children who were already kindergarten age at the time of the intervention. However, there were sufficient numbers of studies to allow a comparison of children across the ages of 0 to 3 and 4 to 5. Results of this analysis are shown in Table 5.4. There was no statistically reliable difference in ESs for studies involving younger children and ESs for studies involving older children ($Q[1, 16] = 0.26$, $p = 0.61$).

Table 5.4. Impact of Home and Parent Interventions on Oral Language Outcome by Ages of Children in Study

Age of Children	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Zero to three	0.42	0.14	0.14	0.69	2.96	7	0.009
Three to five	0.32	0.12	0.09	0.56	2.71	11	0.015

Note: ESs based on random-effect model.

Analysis of Intervention Effects by Type of Intervention

The 18 studies that included oral language as an outcome were diverse in the focus, content, and duration of intervention studied. Two studies examined the effect of training parents to use dialogic reading (DR) (see Chapter Four). Six studies used a home visiting program to either teach parents general stimulation activities for their children or teach parents more focal oral language stimulation activities. Five additional studies taught parents similar general stimulation or language interaction strategies in a university or clinic setting. One of these studies was the Abecedarian project, in which parents received training and support for more than four years. Two studies taught parents to act as speech-language clinicians for their children with speech-language disorders. Two studies investigated the impacts of having parents engage in activities coordinated with activities occurring in their children's kindergarten or preschool. Finally, one study examined the impact of an intervention program that included both parent training and weekly parent-child sessions at the children's preschool.

Given the variability in the types of interventions (e.g., from general stimulation programs for infants to parents acting as speech-language therapists for their children with speech-language disorders) as well as the relatively low number of studies in this group, it was difficult to identify meaningful subgroups of studies to examine possible moderators of ES estimates. The studies included in this group are shown in Appendix 5.A. With few exceptions, there was not significant variability among the observed ESs for the studies. More than half of the studies yielded moderate to large positive ESs. Interventions in the six studies that yielded near zero to negative ESs seemed not to share any obviously meaningful characteristic. One of the studies was the Abecedarian project (e.g., Roberts, Rabinowitch, Bryant, Burchinal, Koch, & Ramey, 1989), which included one of the more focused and intensive parent interventions. One of the studies examined the effects of a general home-visiting program by paraprofessionals and nurses (Olds, 2002). One study examined the effects of teaching parents to encourage and support children's narratives (Peterson, Jesso, & McCabe, 1999). Two studies concerned the impact of parents acting as intervention agents for their children with speech-language disorders (Eiserman, McCoun, & Escobar, 1990; Tannock, Girolametto, & Siegel, 1992), and one study examined the impact of adding a parent-based intervention component to a center-based program (Innocenti, Hollinger, Escobar, & White, 1993).

Studies were classified according to whether and for whom materials were provided as a part of the program. Table 5.5 summarizes this information for the 14 studies in which this information could be coded. Although there was a trend for studies that did not provide materials as part of the program to yield smaller ESs than programs that provided materials for parents, children, or both, these differences were not statistically reliable ($Q[3, 10] = 1.66$, $p = 0.65$). Moreover, the CI for the ES estimate for studies in which no materials were provided overlapped with those for studies that provided materials to parents, children, or both.

Table 5.5. Impact of Home and Parent Programs on Oral Language Outcome by Provision of Materials as Part of Intervention

Materials Provided	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
None	0.26	0.21	–0.16	0.67	1.22	4	0.249
For parent and child	0.53	0.18	0.18	0.88	3.00	4	0.013
For child only	0.49	0.21	0.07	0.91	2.30	3	0.044
For parent only	0.66	0.26	0.15	1.18	2.51	3	0.031

Note: ESs based on random-effect model.

Analysis of Intervention Effects by Demographics of Study Samples

For all analyses of intervention effects, NELP examined variations in estimated ESs for a common set of demographic variables. The demographic variables in these analyses included the socioeconomic status (SES) of the families of the children included in the study samples, ethnic classification of study participants, and the population density of the location where the study was conducted (i.e., rural, urban, suburban, mixed, unknown). In many of the studies included in the summary of home and parent programs, either these demographic characteristics were not reported or the samples used in the studies represented a mix of the demographic categories.

A summary of the results of the analyses for ESs based on the SES of the study samples in home and parent programs is shown in Table 5.6. ES estimates did not vary significantly as a function of the SES classification of the study samples for the oral language outcome ($Q[2, 13] = 0.40$, $p = 0.82$). The majority of studies included populations of children who were classified as low SES. A summary of results of the analyses for ESs for home and parent programs based on the ethnicity of the study sample is shown in Table 5.7. In this analysis, the ES estimates did not vary significantly as a function of ethnicity ($Q[2, 15] = 2.89$, $p = 0.24$). ESs within each classification were statistically significant; however, the majority of study samples were classified as mixed ethnicity or unknown ethnicity. Finally, a summary of the results for the analyses of ESs for home and parent programs based on population density is shown in Table 5.8. In this analysis, ESs did vary significantly as a function of population density ($Q[3, 14] = 11.73$, $p = 0.008$). Examination of the individual groups, however, indicated that this significant variability was between the ES estimate for studies conducted in rural areas and that in all other population-density classifications (i.e., the CI for the rural classification did not overlap those for any of the other classifications). However, the ES estimate for the rural classification was based on a single study, so this significant result is not an interpretable finding.

Table 5.6. Subanalysis for Oral Language Outcomes by Socioeconomic Status Classification of Study Sample

SES Classification	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Low	0.38	0.11	0.16	0.59	3.43	12	0.005
Not low	0.19	0.29	–0.38	0.76	0.65	3	0.528
Unknown	0.41	0.29	–0.17	0.98	1.38	1	0.190

Note: ESs based on random-effect model.

Table 5.7. Subanalysis for Oral Language Outcomes by Ethnicity of Study Sample

Ethnicity	Means	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Caucasian	0.72	0.28	0.19	1.26	2.63	2	0.019
African American	0.48	0.20	0.09	0.87	2.42	4	0.029
Mixed or unknown	0.28	0.09	0.09	0.46	2.93	12	0.010

Note: ESs based on random-effect model.

Table 5.8. Subanalysis for Oral Language Outcomes by Population Density of Study Sample

Group	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Rural	1.53	0.37	0.81	2.26	4.13	1	0.001
Urban	0.22	0.09	0.04	0.41	2.37	8	0.033
Suburban	0.33	0.15	0.04	0.63	2.20	2	0.045
Unknown	0.32	0.12	0.09	0.55	2.68	7	0.018

Note: ESs based on random-effect model.

Summary and Conclusions

Results from this meta-analysis of the impacts of home and parent programs on the literacy skills of young children indicate that these interventions yield a moderate to large effect on oral language outcomes and general cognitive abilities. These effects appear to be robust to variations in children's ages and demographic characteristics of families. Additionally, the effects of these programs on children's oral language skills were consistent across measures of simple vocabulary and measures of more complex oral language skills. Although home and parent programs could impact other aspects of literacy, only a handful of studies included these other outcomes, and no other outcome was included in more than two of these studies (for example, alphabet knowledge [AK] was included in only one study, and phonological awareness [PA] in only two). Therefore, it was not possible to determine whether there were other effects of home and parent programs; consistent with other conclusions in this report, it would seem prudent at this time to rely on

parent programs to address only outcomes that such programs have been proven to stimulate and to employ such interventions in combination with other approaches that address other issues. Future research may be able to expand our understanding of the effectiveness of such parent and home approaches. Also, at this time, there are too few studies to allow fine-grained analysis of the impact of population variables, such as SES, ethnicity, or population density. Given the existing studies, however, there is no evidence that sample characteristics moderate the effects of home and parent interventions programs and no reason to withhold such programs from particular subgroups of children.

The commonality across all of the programs examined by this group of studies is that they somehow involved parents as the agents of intervention for children. Nevertheless, these programs varied greatly in potentially important ways. For example, some of the programs had more general goals (such as trying to improve children's health, behavior, or cognitive functioning); others aimed at more specific literacy goals (such as improving language skills). Because of the great amount of variation evident in these approaches, it is not yet possible to point to one or two examples of replicated models of successfully involving parents in enhancing their children's developmental outcomes. Additional research on identification of key aspects of home and parent programs is needed.

It was not possible to examine the question of the additive effects of home and parent programs in the context of high-quality center-based education programs. A few of the studies contrasted the effects of PI combined with an early childhood program with early childhood programs alone. In some cases, there was an additive effect of the parent program, and, in some cases, there was not. Many of the interventions included in this group of studies involved frequent home visits or one-on-one parent-training sessions. With the growing availability of universally available, federal- or state-funded early childhood education programs, understanding the impact of home and parent programs in the context of high-quality early childhood education deserves attention.

Ultimately, attention to the nature, quality, and scope of home and parent intervention programs is required to identify those likely to be successful and those less likely to be successful. In the majority of studies examined in this meta-analysis, the interventions were delivered to parents by the developers of the intervention or by those who were supervised closely by the developers. Whether such interventions could be taken to scale—implemented broadly by individuals with limited or no contact with the developers—is yet unknown.

Finally, it is important to recognize that none of the more commonly used programs of enhancing PI in young children's literacy development (e.g., Chicago Child-Parent Centers, Parents as Teachers) was evaluated in the set of studies reviewed. Consequently, the results of this meta-analysis do not confirm effectiveness of these specific programs. Notably, only one study included in the analysis involved the typical model in which parent education, parenting education, and parent-child time was evaluated (McQueen & Washington, 1988). Whereas this study yielded a moderate ES (0.74), the degree of PI was relatively intensive. In addition to participating in parent education and parenting classes, each mother worked as a teaching assistant in her child's classroom. In this context, the program was effective. Knowing whether all of these components and this level of intensity are required to achieve a positive outcome are questions that need to be addressed by future studies.

Research Studies Synthesized in the Analysis of Parent and Home Programs

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Crain-Thoreson, C., & Dale, P. S. (1999). Enhancing linguistic performance: Parents and teachers as book reading partners for children with language delays. *Topics in Early Childhood Special Education*, *19*(1), 28–39.

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Goodwyn, S. W., Acredolo, L. P., & Brown, C. A. (2000). Impact of symbolic gesturing on early language development. *Journal of Nonverbal Behavior*, *24*(2), 81–103.

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Innocenti, M. S., Hollinger, P. D., Escobar, C. M., & White, K. R. (1993). The cost-effectiveness of adding one type of parent involvement to an early intervention program. *Early Education and Development*, *4*(4), 306–326.

Johnson, D. L., & Walker, T. (1991). A follow-up evaluation of the Houston Parent-Child Development Center: School performance. *Journal of Early Intervention*, *15*(3), 226–236.

Jordan, G. E., Snow, C. E., & Porche, M. B. (2000). Project EASE: The effort of a family literacy project on kindergarten students' early literacy skills. *Reading Research Quarterly*, *35*(4), 524–556.

Klein, P. S., & Alony, S. (1993). Immediate and sustained effects of maternal mediating behaviors on young children. *Journal of Early Intervention*, *17*(2), 177–193.

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McQueen, A., & Washington, V. (1988). Effect of intervention on the language facility of poor, black adolescent mothers and their preschool children. *Early Child Development and Care*, *33*, 137–152.

Metzl, M. N. (1980). Teaching parents a strategy for enhancing infant development. *Child Development*, *51*(2), 583–586.

Olds, D. L., Robinson, J., O'Brien, R., Luckey, D. W., Pettitt, L. M., Henderson, C. R., et al. (2002). Home visiting by paraprofessionals and by nurses: A randomized, controlled trial. *Pediatrics*, *110*(3), 486–497.

Peterson, C., Jesso, B., & McCabe, A. (1999). Encouraging narratives in preschoolers: An intervention study. *Journal of Child Language*, *26*(1), 49–67.

Roberts, J. E., Rabinowitch, S., Bryant, D. M., Burchinal, M. R., Koch, M. A., & Ramey, C. T. (1989). Language skills of children with different preschool experiences. *Journal of Speech and Hearing Research*, *32*, 773–800.

Slater, M. A. (1986). Modification of mother-child interaction processes in families with children at-risk for mental retardation. *American Journal of Mental Deficiency*, *91*(3), 257–267.

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Tannock, R., Girolametto, L., & Siegel, L. S. (1992). Language intervention with children who have developmental delays: Effects of an interactive approach. *American Journal on Mental Retardation*, *97*(2), 145–160.

Whitehurst, G. J . Epstein, J. N, Angell, A. L., Payne, A. C., Crone, D. A., & Fischel, J. E. (1994). Outcomes of an emergent literacy intervention in Head Start. *Journal of Educational Psychology*, *86*(4), 542–555.

Whitehurst, G., Zevenbergen, A., Crone, D., Schultz, M., Velting, O., & Fischel, J. (1999). Outcomes of an emergent literacy intervention from Head Start through second grade. *Journal of Educational Psychology*, *91*(2), 261–272.

Zevenbergen, A. A., Whitehurst, G. J., & Zevenbergen, J. A. (2003). Effects of a shared-reading intervention on the inclusion of evaluative devices in narratives of children from low-income families. *Journal of Applied Developmental Psychology*, *24*(1), 1–15.

Appendix 5.A. Primary Coding of Home and Parent Program Studies with Oral Language Outcome Measures

Study	Type of Study[a]	Child Age[b]	Material[c]
Barnett, W. S., Escobar, C. M., & Ravsten, M. T. (1988). Parent and clinic early intervention for children with language handicaps: A cost-effectiveness analysis. *Journal of the Division for Early Childhood, 12*(4), 290–298.	1	1	4
Crain-Thoreson, C., & Dale, P. S. (1999). Enhancing linguistic performance: Parents and teachers as book reading partners for children with language delays. *Topics in Early Childhood Special Education, 19*(1), 28–40.	1	0	—
Cronan, T. A., Brooks, L. B., Kilpatrick, K., Bigatti, S. M., & Tally, S. (1999). The effects of a community-based literacy program: One-year follow-up findings. *Journal of Community Psychology, 27*(4), 431–442.	2	1	3
Donachy, W. (1976). Parent participation in pre-school education. *British Journal of Educational Psychology, 46*, 31–39.	2	0	4
Eiserman, W. D., McCoun, M., & Escobar, C. M. (1990). A cost-effectiveness analysis of two alternative program models for serving speech-disordered preschoolers. *Journal of Early Intervention, 14*(4), 297–317.	1	0	3
Gray, S. W., & Ruttle, K. (1980). The family-oriented home visiting program: A longitudinal study. *Genetic Psychology Monographs, 102*, 299–316.	1	1	3
Innocenti, M. S., Hollinger, P. D., Escobar, C. M., & White, K. R. (1993). The cost-effectiveness of adding one type of parent involvement to an early intervention program. *Early Education and Development, 4*(4), 306–326.	1	0	1
Jordan, G. E., Snow, C. E., & Porche, M. V. (2000). Project EASE: The effect of a family literacy project on kindergarten students' early literacy skills. *Reading Research Quarterly, 35*(4), 524–546.	2	0	2
Klein, P. S., & Alony, S. (1993). Immediate and sustained effects of maternal mediating behaviors on young children. *Journal of Early Intervention, 17*(2), 177–193.	1	1	—
Levenstein, P. (1970). Cognitive growth in preschoolers through verbal interaction with mothers. *American Journal of Orthopsychiatry, 40*(3), 426–432.	2	0	2

SES[d]	Ethnicity[e]	Population Density[f]	ES
2	4	5	0.81
—	4	5	0.29
1	4	5	0.58
—	4	2	0.54
2	1	3	0.04
1	4	5	0.83
1	4	2	–0.03
3	4	3	0.41
1	4	2	0.51
1	2	2	0.41

Study	Type of Study[a]	Child Age[b]	Material[c]
McQueen, A. B., & Washington, V. (1988). Effect of intervention on the language facility of poor, black adolescent mothers and their preschool children. *Early Child Development and Care, 33*, 137–152.	1	0	2
Olds, D. L., Robinson, J., O'Brien, R., Luckey, D. W., Pettit, L. M., Henderson, C. R., Ng, R. K., Sheff, K. L., Korfmacher, J., Hiatt, S., & Talmi, A. (2002). Home visiting by paraprofessionals and by nurses: A randomized, controlled trial. *Pediatrics, 110*(3), 486–496.	1	1	—
Peterson, C., Jesso, B., & McCabe, A. (1999). Encouraging narratives in preschoolers: An intervention study. *Journal of Child Language, 26*, 49–67.	1	0	1
Roberts, J. E., Rabinowitch, S., Bryant, D. M., Burchinal, M. R., Koch, M. A., & Ramey, C. T. (1989). Language skills of children with different preschool experiences. *Journal of Speech & Hearing Research, 32*, 773–786.	1	1	—
Slater, M. A. (1986). Modification of mother-child interaction processes in families with children at-risk for mental retardation. *American Journal of Mental Deficiency, 91*(3), 257–267.	1	0	1
Slaughter, D. T. (1983). Early intervention and its effects on maternal and child development. *Monographs of the Society for Research in Child Development, 48*(4), 1–83.	2	1	
Slaughter (1983).			2
Slaughter (1983).			4
Tannock, R., Girolametto, L., & Siegel, L. S. (1992). Language intervention with children who have developmental delays: Effects of an interactive approach. *American Journal on Mental Retardation, 97*(2), 145–160.	1	0	1
Zevenbergen, A. A., Whitehurst, G. J., & Zevenbergen, J. A. (2003). Effects of a shared-reading intervention on the inclusion of evaluative devices in narratives of children from low-income families. *Applied Developmental Psychology, 24*, 1–15.	1	0	—

[a] *Design: 1 = RCT, 2 = QED.*

[b] *Child age: 0 = 3 years to kindergarten, 1 = birth to 3 years.*

[c] *Material: 1 = No material provided, 2 = material provided for parent and child, 3 = material provided for child only, 4 = material provided for parent only.*

[d] *SES: 1 = Low SES, 2 = Not low SES, 3 = mixed SES.*

[e] *Ethnicity: 1 = Caucasian, 2 = African American, 3 = Hispanic or Latino, 4 = mixed or unknown.*

[f] *Population density: 1 = Rural, 2 = urban, 3 = suburban, 4 = mixed, 5 = unknown.*

SES[d]	Ethnicity[e]	Population Density[f]	ES
1	2	2	0.74
1	4	2	0.05
1	4	5	–0.57
1	2	5	0.07
1	1	1	1.53
1	2	2	0.72
			0.73
			0.71
2	4	2	–0.11
1	4	5	0.18

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Innocenti, M. S., Hollinger, P. D., Escobar, C. M., & White, K. R. (1993). The cost-effectiveness of adding one type of parent involvement to an early intervention program. *Early Education and Development, 4*(4), 306–326.

McQueen, A., & Washington, V. (1988). Effect of intervention on the language facility of poor, black adolescent mothers and their preschool children. *Early Child Development and Care*, *33*, 137–152.

Olds, D. L., Robinson, J., O'Brien, R., Luckey, D. W., Pettitt, L. M., Henderson, C. R., et al. (2002). Home visiting by paraprofessionals and by nurses: A randomized, controlled trial. *Pediatrics*, *110*(3), 486–497.

Peterson, C., Jesso, B., & McCabe, A. (1999). Encouraging narratives in preschoolers: An intervention study. *Journal of Child Language*, *26*(1), 49–67.

Roberts, J. E., Rabinowitch, S., Bryant, D. M., Burchinal, M. R., Koch, M. A., & Ramey, C. T. (1989). Language skills of children with different preschool experiences. *Journal of Speech & Hearing Research*, *32*, 773–800.

Snow, C. E., Barnes, W. S., Chandler, J., Goodman, I. F., & Hemphill, L. (1991). *Unfulfilled expectations: Home and school influences on literacy.* Cambridge, Mass.: Harvard University Press.

Tabors, P. O., Snow, C. E., & Dickinson, D. K. (2001). Homes and schools together: Supporting language and literacy development. In D. K. Dickinson & P. O. Tabors (Eds.), *Beginning literacy with language: Young children learning at home and school* (pp. 313–334). Baltimore: Brookes.

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Chapter 6

IMPACT OF PRESCHOOL AND KINDERGARTEN PROGRAMS ON YOUNG CHILDREN'S EARLY LITERACY SKILLS

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A variety of early childhood programs have been studied since the early 1960s to determine their effectiveness in improving social and academic outcomes for young children. For example, Perry Preschool Project (Schweinhart, Montie, Xiang, Barnett, Belfield, & Nores, 2005; Schweinhart & Weikart, 1980, 1997; Weikart, Bond, & McNeil, 1978) and the federally funded program Head Start, along with a variety of state preschool programs, have been the focus of research (Gilliam & Zigler, 2000) (as have other programs, such as the Abecedarian project [Ramey & Campbell, 1984], the Chicago Child-Parent Center [Reynolds, 1999], and a plethora of early prevention efforts) (Nelson, Westhues, & MacLeod, 2003). All of these programs have focused on children in poverty or who are at risk for educational or social failure, and they have included a broad range of program services, including education, nutrition, health and social services, home-visiting interactions, and parent support. Provision of services in these programs targeted varied ages, including infants and preschoolers who were then followed into kindergarten, early elementary school, and beyond.

The National Early Literacy Panel (NELP) examined the effectiveness of several of such preschool and kindergarten programs and interventions aimed at the development of early literacy and conventional literacy skills.[1] (Unfortunately, the studies of some of the widely known programs have either not been reported in refereed journals or have not focused on literacy-learning outcomes, so they could not be examined here). The panel set out to determine whether such programs confer children with an advantage in literacy learning or in the development of early skills that predict later literacy success. The studies included in this chapter met the selection criteria established by the panel for the meta-analysis including (1) group design using

[1] Several studies that examined code-focused interventions (see Chapter Three) could have been double counted, since many of those studies were carried out within preschools and kindergartens. Some of the book-sharing (Chapter Four) and language intervention studies (Chapter Seven) could have been included here as well. However, given the sufficient numbers of such studies in the other sets, the panel members believed it best to consider them separately, so this chapter considers school-based interventions that could not accurately be included in those other chapters.

either a randomized control trial (RCT) or a quasiexperimental design (QED) with initial group equivalency, (2) an intervention that measured effectiveness on early literacy or conventional literacy skills, and (3) sufficient data to calculate an effect size (ES). A total of 33 studies met these criteria. Ten of these studies evaluated the effectiveness of the Abecedarian project, and, since nine of these studies involved the same sample of children longitudinally, the results of these nine studies were combined and treated as a single group.

Overall Estimates of Intervention Impacts

Table 6.1 provides a summary of the overall effects of the various preschool and kindergarten interventions across all the different outcomes. The table includes, for each outcome variable (in alphabetical order), the number of studies that contributed to the ES estimates, an estimate of the ES based on a random-effect model,[2] the 95 percent upper and lower bounds of the ESs, and the statistical significance of the ESs. The majority of the studies in this category provided effects for oral language (12 studies) and reading (nine studies). Fewer studies examined the impact of these interventions on alphabet knowledge (AK) (four studies), cognitive ability (four studies), readiness (three studies), spelling (three studies), phonological awareness (PA) (two studies), memory (two studies), print knowledge (two studies) and writing (two studies). Although cognitive ability per se did not arise in the predictor study, this variable is closely aligned with the various measures of IQ that were found to have predictive value in that earlier analysis. For that reason, the cognitive ability outcome is examined here.

As indicated in Table 6.1, preschool- and kindergarten-based interventions resulted in large, statistically significant outcomes for readiness measures (1.23) and small to moderate effects on spelling measures (0.34). Although statistically significant effects also were found for memory (0.47) and print knowledge (1.00), these outcomes were measured in too few studies to allow for a reliable determination of the impact of preschool and kindergarten experiences on these skills. It should be noted that readiness tests do not represent a single skill; they are composite measures encompassing many early literacy predictors, including AK, concepts of print, vocabulary, memory, and PA.

Although the average ESs for preschool and kindergarten programs were large enough to be of educational importance for several literacy variables (such as reading, writing, and AK), these differences did not reach statistical significance for the small numbers of studies combined in these analyses. Perhaps as more studies are completed with these kinds of outcomes, it would be possible to conclude that kindergarten and preschool interventions have a general ability to improve student literacy performance. However, the oral language outcomes were both statistically insignificant and so small as to be of questionable importance, though preschool and kindergarten efforts with a more explicit focus on oral language development may have very different results.

[2] Except where noted, all ES estimates and associated statistics are based on a random-effect model.

Table 6.1. Estimates of Effect Sizes Across Domains for Interventions Involving Preschool and Kindergarten Programs for Each Dependent Variable

Dependent Variable	Fixed ES	Random ES	95% CI		*N of Studies*	*p* for ES
			Lower Bound	Upper Bound		
AK	0.31	0.23	–0.18	0.64	4	0.27
Cognitive ability	0.30	0.35	–0.11	0.80	4	0.13
Memory	0.47	0.47	0.15	0.79	2	0.004
Oral language	0.10	0.13	–0.06	0.31	12	0.17
PA	0.08	0.08	–0.15	0.31	2	0.49
Print knowledge	1.00	0.98	0.25	1.70	2	0.008
Readiness	1.23	1.22	0.05	2.38	3	0.04
Reading	2.05	0.75	–0.38	1.89	9	0.19
Spelling	0.34	0.34	0.07	0.60	3	0.01
Writing	0.72	0.67	–0.14	1.48	2	0.11

Note: CI= CI based on random-effect model.

Estimates of Intervention Impacts by Demographic Characteristics of Study Samples

NELP was interested in whether preschool and kindergarten programs had differential effects for children from different demographic groups, including socioeconomic status (SES), ethnicity, age of the children, and the population density of the location where the study was conducted (i.e., rural, urban, suburban, mixed or unknown). In many instances, these data were not reported in the research articles or the samples of children within the studies were mixed, resulting in too few studies to allow for interpretation.

Socioeconomic Status

Half of the studies with oral language outcomes were conducted with children of low SES (n = 6). Only one other study with oral language outcomes reported SES of the children, and that included a mixed sample, which makes it impossible to interpret this effect. Likewise, even fewer studies with reading outcomes reported SES information (n = 4). Although the large effect reported for reading outcomes in the one study with mixed-SES children was significantly different from that for the other groups (Q [2, 1] = 54.40, p < 0.001), the limited number of studies (n < 3) contributing to this effect does not allow for meaningful interpretation. The results of the SES analysis are included in Table 6.2.

Table 6.2. Effect Sizes for Oral Language and Reading Outcomes for Preschool and Kindergarten Program Interventions Based on Socioeconomic Status of Study Sample

SES	Outcome	Mean ES	SE	95% CI		*t*	*n*	*p*
				Lower Bound	Upper Bound			
Low SES	Oral language	0.32	0.12	0.08	0.56	2.56	6	0.05
	Reading	0.08	0.07	–0.05	0.21	1.18	2	0.45
Not low SES	Oral language	—	—	—	—	—	—	—
	Reading	0.27	0.25	–0.21	0.75	1.08	1	0.47
Mixed SES	Oral language	0.22	0.12	–0.02	0.45	1.83	1	0.13
	Reading	1.19	0.39	0.92	1.45	8.85	1	0.07

Age

Many more studies with oral language outcomes included prekindergarten than included kindergarten children. The reverse was true for studies with reading outcomes, as only two of the nine studies include children younger than kindergarten age. The results of the age subanalysis are included in Table 6.3. Although the ES estimate for interventions with reading outcomes that included kindergarten children was larger than that for prekindergartners, this effect was not statistically reliable ($Q[1,7] = 0.68$, $p = 0.41$). And while the comparison of interventions with oral language outcomes by age was statistically significant ($Q[1,10] = 6.18$, $p = 0.01$), the confidence intervals (CIs) overlapped, indicating that there was no evidence that age moderated the impact of the preschool and kindergarten programs on oral language outcomes.

Table 6.3. Effect Sizes for Oral Language and Reading Outcomes of Preschool and Kindergarten Program Interventions Based on Age of Study Sample

Age	Outcome	Mean ES	SE	95% CI		*t*	*n*	*p*
				Lower Bound	Upper Bound			
Prekindergarten	Oral language	–0.03	0.08	–0.20	0.13	–0.44	9	0.67
	Reading	0.33	0.59	–0.83	1.49	0.55	2	0.60
Kindergarten	Oral language	0.28	0.09	0.09	0.46	2.95	3	0.01
	Reading	0.88	0.32	0.21	1.31	2.79	7	0.03

Ethnicity

Overall, there were insufficient numbers of studies of either oral language or reading outcomes to determine whether children's ethnicity had any impact on the effectiveness of the interventions. For preschool and kindergarten programs with reading outcomes, only two groups could be compared, and the majority of these studies included mixed samples of children. The results of this subanalysis, shown in Table 6.4, indicate no statistically significant differences between these two groups ($Q[1,7] = 0.36$, $p = 0.55$). Moreover, with only one study including a single ethnic group, there is no way to discern whether the effects of ethnicity moderated the impact of preschool and kindergarten programs on reading outcomes. Although there were more ethnic groups represented in the preschool and kindergarten program interventions with oral language

outcomes, the majority of these studies included mixed samples of children, and only one study each using Caucasian, African American, and Hispanic populations. There were no statistically significant differences among these groups ($Q[3, 8] = 2.99$, $p = 0.39$), and, because of the limited number of studies for these ethnic classifications, the estimated ESs were not interpretable.

Table 6.4. Effect Sizes for Oral Language and Reading Outcomes for Preschool and Kindergarten Program Interventions Based on Ethnicity of Study Sample

Ethnicity	Outcome	Mean ES	SE	95% CI		*t*	*n*	*p*
				Lower Bound	Upper Bound			
Caucasian	Oral language	–0.58	0.46	–1.47	0.31	–1.27	1	0.24
	Reading	0.27	0.87	–1.41	1.96	0.31	1	0.77
African American	Oral language	0.07	0.36	–0.64	0.79	0.20	1	0.85
	Reading	—	—	—	—	—	—	—
Hispanic	Oral language	0.38	0.33	–0.27	1.02	1.13	1	0.29
	Reading	—	—	—	—	—	—	—
Mixed	Oral language	0.13	0.09	–0.05	0.31	1.46	9	0.18
	Reading	0.82	0.30	0.23	1.41	2.72	8	0.03

Population Density

The majority of studies with oral language and reading outcomes did not provide sufficient information to classify where the study was conducted according to population density (rural, urban, suburban, or mixed). For preschool and kindergarten program interventions with oral language outcomes, the subanalysis included four studies classified as urban and eight studies classified as unknown (see Table 6.5). No study with oral language outcomes was classified as rural, suburban, or mixed, causing too few instances to generate reliable ES estimates. Differences in the ES estimates were not statistically significant ($Q[1,9] = 0.19$, $p = 0.19$). Studies that included preschool and kindergarten program interventions with reading outcomes had too few studies classified to interpret the impact of population density. The differences were not statistically reliable ($Q[2,5] = 0.94$, $p = 0.63$).

Table 6.5. Effect Sizes for Oral Language and Reading Outcomes for Preschool and Kindergarten Program Interventions Based on Population Density of Study Sample

Population Density	Outcome	Mean ES	SE	95% CI		*t*	*n*	*p*
				Lower Bound	Upper Bound			
Urban	Oral language	0.18	0.13	–0.08	0.45	1.37	4	0.20
	Reading	0.78	0.61	–0.41	1.97	1.29	2	0.25
Mixed	Oral language	—	—	—	—	—	—	—
	Reading	0.04	0.84	–1.62	1.70	0.04	1	0.96
Unknown	Oral language	0.10	0.13	–0.15	0.36	0.78	7	0.45
	Reading	0.94	0.39	0.18	1.70	2.43	5	0.06

Estimates of Intervention Impacts by Characteristics of Interventions

The panel was interested in the characteristics of the interventions that moderate effects on early literacy and conventional literacy outcomes. To conduct analyses on these moderator variables, a sufficient number of studies had to have the same outcomes. Only two outcomes, oral language and reading, had sufficient, though small, numbers of studies to make these comparisons.

RCTs and QEDs (with pretest equivalency of the comparison groups) were used to determine the impact of preschool and kindergarten interventions on early literacy skills and conventional literacy. A subanalysis comparing the experimental and quasiexperimental studies was conducted to ascertain the effects of study design of these interventions on oral language and reading outcomes. The results of this analysis are included in Table 6.6. Four experimental studies were compared to eight quasiexperimental studies with oral language outcomes. There were no statistically significant differences in the estimates of ESs for these studies ($Q[1,10]$, $p = 0.69$). For reading outcomes, there were three experimental interventions and six quasiexperimental interventions. The difference in the estimated ESs for these studies was statistically significant ($Q[1,7] = 8.12$, $p = 0.004$). However, further examination revealed that two of the three experimental studies involved teacher professional development (PD), whereas only one of the six quasiexperimental studies included this intervention. Therefore, the impact should be interpreted with caution because of the confounding of study type with teacher PD.

Table 6.6. Effect Sizes for Oral Language and Reading Outcomes for Preschool and Kindergarten Program Interventions Based on Type of Study Design

Study Design	Outcome	Mean ES	SE	95% CI		*t*	*n*	*p*
				Lower Bound	Upper Bound			
RCT	Oral language	0.08	0.14	–0.19	0.35	0.60	4	0.56
	Reading	1.60	0.36	0.89	2.30	4.44	3	0.003
QED	Oral language	0.16	0.09	–0.08	0.39	1.32	8	0.22
	Reading	0.33	0.26	–0.18	0.84	1.27	6	0.24

When NELP examined the research to identify early skills that predicted later conventional forms of literacy, the complex forms of oral language skills (e.g., grammar and definitional vocabulary) were determined to be better predictors of later literacy than was simple vocabulary. Therefore, the panel examined whether there were differences in outcome from preschool and kindergarten programs when vocabulary and composite oral language were the outcome measures. Five studies assessed outcomes of simple vocabulary, and six considered composite measures of oral language; several studies used both vocabulary and composite oral language measures, so there is some overlap in the number of studies contributing to the estimate of ESs. Three studies were excluded from this analysis because they measured communication or oral language only and could not be categorized appropriately. Although the estimated ES for the composite measure was higher than that for the measures of vocabulary, this difference was not statistically reliable. The results of this analysis are included in Table 6.7.

Table 6.7. Effect Sizes of Preschool and Kindergarten Program Interventions on Measures of Simple Vocabulary and Composite Measures of Oral Language

Measure	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Vocabulary	0.13	0.13	–0.12	0.38	1.03	5	0.30
Composite	0.40	0.15	0.11	0.68	2.73	6	0.006

Three characteristics of the various preschool and kindergarten program interventions were reported in sufficient detail in enough studies to allow them to be analyzed. Separate analyses by outcome variable were conducted for interventions that implemented literacy-focused curricula, PD for teachers, and parental involvement (PI) associated with the kindergarten or preschool program.

Literacy-Focused Curricula

Three studies examined the impact of the use of literacy-focused curricula in kindergarten classrooms, and all of these studies examined readiness as an outcome. Two of the interventions were implemented with at-risk kindergarten children and the third with preschoolers. One of the kindergarten interventions was a two-year study following children into first grade and measured achievement at the ends of the kindergarten and first-grade years. Children were assessed in kindergarten, and the results were used to identify children's strengths and weaknesses for planning individual programs. Small groups of two to four children with similar needs were formed, and groups rotated through learning stations targeted to specific needs that were monitored by parent aides trained to work with the children. In addition to the learning stations that were stocked with educational materials to reinforce language, perceptual-motor, and number-concept skills, children were involved in a structured prereading program to teach letter names and letter sounds. Enrichment activities enhancing gross motor skills and music were also offered to kindergartners in the experimental group.

The other kindergarten study was implemented with French-speaking children in Canada. The intervention in this study incorporated a multicomponent literacy program that included a well-stocked library corner and writing corner; opportunities to engage in reading and writing in the context of play; functional reading of text and writing of children's names; and daily story reading. In addition, a structured method (20 lessons) of PA training was used in a meaningful literacy context using nursery rhymes, writing, and word play. Along with the kindergarten literacy program, parents were invited to four 90-minute sessions at the beginning of the year to receive suggested activities and practical material. In half of the experimental classrooms, in addition to the basic literacy program, children received semiweekly PA sessions in which phonological activities were integrated into reading and writing events. Children participated in small groups of four to six for a total of 45 sessions, each 25 to 30 minutes long, over a period of eight months. Comparison children received the traditional kindergarten program consisting of a free-play curriculum, though they also received the 20 lessons in phoneme awareness (though not embedded in the experimental literacy context).

The third study was implemented with preschoolers, ages three to five years, in two child-care centers in an urban area. The intervention was structured to provide literacy enrichment by arranging the space for sustained play in literacy-relevant contexts (e.g., post office, library), with authentic literacy objects (e.g., cookbooks, recipe cards). Nonintervention classrooms made no changes to the classroom play environments.

As indicated in Table 6.1, these studies of various literacy curricula had an average ES of 1.23, which is large and statistically significant. All three of these studies also examined oral language outcomes, so their results were compared with those of the other studies that had oral language outcomes but did not implement literacy-focused curricula. Results of this analysis are shown in Table 6.8. There was no statistically significant difference between studies that implemented literacy-focused curricula with oral language outcomes and those that did not ($Q[1, 10] = 0.06$ $p = 0.81$).

Several studies with literacy-focused curricula measured the effects of those interventions on reading. One of the studies in this subcategory that was not discussed previously implemented the Reading Mastery (RM) curricula (Englemann & Bruner, 1995). These curricula, conducted with severely at-risk kindergarten through second-grade students, provided students with explicit instruction in phonemic awareness and decoding. Teachers received intensive in-service teacher training and year-long support within the schools in the form of feedback on program planning and implementation. The four studies with literacy-focused curricula that measured reading outcomes were compared to five studies with reading outcomes that did not implement literacy-focused curricula. The results of this comparison are shown in Table 6.9. There was a significant difference between the kindergarten programs with a literacy focus and those without a literacy focus ($Q[1, 7] = 3.85$ $p = 0.05$). Further examination of these studies indicated that the literacy-focused curriculum interventions yielded an estimated mean ES between approximately three and a half to four times larger than those for studies that did not use a literacy-focused curriculum.

Table 6.8. Effect Sizes for Oral Language and Reading Outcomes for Preschool and Kindergarten Program Interventions with Literacy-Focused Curricula

Literacy Focus	Outcome	Mean ES	SE	95% CI		*t*	*n*	*p*
				Lower Bound	Upper Bound			
No	Oral language	0.11	0.11	–0.12	0.33	0.94	9	0.37
	Reading	0.33	0.33	–0.31	0.97	1.01	5	0.34
Yes	Oral language	0.15	0.14	–0.13	0.43	1.06	3	0.31
	Reading	1.29	0.36	0.58	2.00	3.56	4	0.009

Professional Development

PD of teachers was another characteristic of the interventions that was of interest for determining features that moderate the impact of preschool and kindergarten programs. For oral language outcomes, only two studies implemented PD with teachers, and 10 studies did not implement PD. Results of this comparison are shown in Table 6.9. There was no statistically significant

difference in the ES estimates between these groups ($Q[1,10] = 1.04$, $p = 0.31$); moreover, the small number of studies with PD ($n < 3$) in this comparison does not allow for interpretation.

In contrast, there were enough studies to compare effects of PD in kindergarten programs on reading outcomes. Three studies implemented PD, and six studies did not. All three of the studies that implemented PD were included in the set of four studies that involved the impact of literacy-focused curricula on reading outcomes and have been described in previous analyses. Estimates of the effects of kindergarten programs with PD are shown in Table 6.9. The results of this comparison indicated a statistically significant difference in the groups on reading outcomes ($Q[1, 7] = 1420.23$, $p < 0.000$). There was a stronger effect for the studies that implemented PD; however, it is likely that the estimation of the effects of PD in this analysis were not independent of the effects of literacy-focused curricula in these kindergarten programs, and, in combination, these characteristics of the interventions produced very strong effects on reading outcomes.

Table 6.9. Effect Sizes for Oral Language and Reading Outcomes for Preschool and Kindergarten Program Interventions with Professional Development

PD	Outcome	Mean ES	SE	95% CI		*t*	*n*	*p*
				Lower Bound	Upper Bound			
No	Oral language	0.18	0.10	–0.02	0.39	1.77	10	0.11
	Reading	0.17	0.06	0.06	0.28	3.00	6	0.02
Yes	Oral language	0.002	0.14	–0.28	0.28	0.01	2	0.99
	Reading	2.05	0.03	2.59	2.72	81.42	3	0.000

Parental Involvement

Interventions could also be compared in terms of PI. Only three studies with oral language outcomes included some form of PI associated with the preschool or kindergarten program, and the three forms differed in their approaches. Two of the studies included prekindergarten children—one with very young low-income children and the other with prekindergarten children with disabilities. The third study involved kindergarten children of mixed income. The one study involving at-risk children included a language-enriched day care plus parent-education intervention and a parent intervention alone. Children entered the day-care program between the ages of six weeks and three months and attended five full days per week for 50 weeks per year until they entered kindergarten. The two treatment conditions were compared to a no-treatment control. The parent-education program included home visits every 1.5 weeks and parent-group meetings each month that focused on learning games, child management, and parent problem-solving regarding the child. Each family received a notebook of materials that contained developmental information, record-keeping materials, parent-skill information, and an index of learning activities. Another intervention involved a comparison of both low-income and high-income schools that received a number of high-quality children's books plus teacher training with schools that received books only. Control schools did not receive books or training. In the training schools, teachers received 130 books for a parents' lending library and parents attended two one-hour evening parent sessions and received a total of five copies of children's

books. No further description of the parent sessions was reported. The third intervention in this subcategory compared a current classroom delivery system to the same system enhanced by one type of systematic PI. The classroom intervention included half-day, five-day-per-week services with large-group, small-group, and one-to-one individualized services for children with special needs. The PI intervention consisted of parent meetings organized around the Parents Involved in Education (PIE) curriculum (Pezzino & Lauritzen, 1986). PIE training modules were designed to provide parents with a systematic, conceptual, and hands-on experience in such areas as child development, observation and recording, targeting intervention behaviors, teaching processes, decisionmaking, and communicating with professionals. The training format included small groups of eight to 12 parents in lecture, discussion, and demonstrations for a total of 16 two-hour meetings once per week. In addition to the modules, there was a social-support component and practice at home.

The three studies including PI were compared with nine studies that did not include PI for oral language outcomes. As seen in Table 6.10, the mean ES estimates for PI interventions and interventions without PI are similarly small, and differences between these groups were not statistically reliable ($Q[1,10] = 0.00$, $p = 0.99$). As shown in Table 6.10, no preschool and kindergarten interventions with reading outcomes included PI as a feature of the program. Therefore, no analysis could be conducted to discern these effects.

Table 6.10. Effect Sizes for Oral Language Outcomes for Preschool and Kindergarten Program Interventions with Parent Involvement

PI	Outcome	Mean ES	SE	95% CI		*t*	*n*	*p*
				Lower Bound	Upper Bound			
No	Oral language	0.13	0.11	–0.08	0.33	1.17	9	0.27
	Reading	—	—	—	—	—	—	—
PI	Oral language	0.12	0.16	–0.18	0.43	0.78	3	0.45
	Reading	—	—	—	—	—	—	—

Summary and Conclusions

Preschool and kindergarten programs do affect young children's development of conventional literacy skills as well as important emergent literacy skills. Results of the meta-analyses examining the overall effects of preschool and kindergarten programs across outcome measures revealed two main findings. The largest impact of the preschool and kindergarten programs was on the composite measure of readiness, indicating that they were highly effective in preparing children for school entry.

The other main effect was a small to moderate impact of programs on spelling outcomes. Although the ES for spelling was smaller than that for readiness, it is significant that only kindergarten programs improved spelling. This might have resulted from the possibility that kindergarten programs were more likely to focus on spelling; such skills are rarely expected of preschoolers. Early spelling work is often proposed as a valuable component of beginning reading instruction because it involves the integration of phonemic awareness skills with AK. The studies

that contributed to this finding also included literacy-focused curricula, including teacher PD, further reinforcing the importance of these variables for effective implementation.

A number of the other outcome variables had sufficient numbers of studies to allow for a meta-analysis of the results. For example, oral language had 12 studies, reading had nine studies, and AK and cognitive ability had four studies each. Yet, none of these outcome variables reached statistical significance. As has been explained earlier, in a meta-analysis magnitude of difference is as important as statistical significance. In this case, the oral language outcomes seem particularly modest, meaning that the range of preschool and kindergarten programs examined here would not be expected to exert much impact on this outcome. But contrast this with the large ES for reading outcomes; although, again, this difference did not reach statistical significance, the size of the difference is so large as to be of educational importance. These findings suggest that kindergarten and preschool programs can have an impact on children's reading development.

Additional analyses focused on identifying how the research design of studies of intervention effectiveness, such as preschool and kindergarten programs to affect early learning and school readiness, influence findings. In intervention-efficacy studies, it is important that sufficient controls are in place so that treatment effects can be separated from effects from no treatment or alternative treatment conditions. Analyses to compare the effects of RCT and QED found no differences between these research designs in studies of oral language outcomes, but there were differences between designs in studies of reading outcomes. The RCT reflected greater impacts for reading outcomes, although these findings may also reflect differences in whether teacher PD was included in the study. These findings suggest a need in future research for the characteristics of preschool and kindergarten programs to be explicitly compared.

The most commonly measured outcome in all of the NELP intervention categories was oral language. Nine of the 33 preschool and kindergarten program studies included a composite measure of oral language skills, a measure of vocabulary, or both. The estimated ESs for programs on oral language and for vocabulary tended to be small, and these effects were not statistically reliable.

The impacts of three types of preschool or kindergarten program characteristics were examined: literacy-focused curricula, PD for teachers, and PI. The presence of literacy-focused curricula and the availability of PD for teachers both strongly affected the reading outcomes for children in kindergarten programs. However, with the studies' inclusion of both literacy-focused curricula and PD for teachers, it is impossible to separate the effects of the curriculum from the provision of teacher PD. Additionally, the studies contributing to this finding all focused on kindergarten children only; there is a clear need for research that examines such efforts with preschool children.

Studies involving preschool and kindergarten programs with PI did not yield significant findings or sizable effects. Such findings had not been expected because of the reported effectiveness of high-profile preschool and kindergarten programs with strong PI (e.g., Abecedarian project, Chicago Child-Parent Center Study, Head Start, and the Perry Preschool Project). It appears that, although PI in preschool or kindergarten programs has been strongly encouraged in the field, the specific impacts of such PI on early literacy outcomes have not been widely studied, and there is not yet a clear, empirically proven best way to use this involvement toward improved literacy performance for young children.

There is great interest in the impact of instructional programs on the learning of different racial, ethnic, linguistic, and economic groups of children. The data on preschool and kindergarten programs simply were not adequate to permit this kind of analysis. Future research will need to explore this issue more directly.

Future Research

More research is needed in several areas. For instance, very few experimental or quasiexperimental studies included children who are English-language learners or who have special education needs. The incidence of such children is increasing in early childhood classrooms, so it is important that there be an evidence base from which guidance can be sought on program effectiveness.

Few studies have included infant or toddler programs as a focus of research for the promotion of early literacy skills. Although the studies published from the Abecedarian project contributed to findings reported here, there were few studies of very young children. More research in this area could identify the features and strengths of infant and toddler programs for improving literacy outcomes. Such studies would need to be longitudinal in design so that impacts of infant and toddler programs and concurrent assessments of the infants' skills can be related to later measures of emergent literacy and conventional literacy skills.

Also, there were fewer studies of preschool programs than of kindergarten programs. This mismatch stands in stark contrast to the increasing emphasis on the expansion of preschool enrollment toward making children more academically ready for kindergarten and first grade. An evidence base is needed to define and measure the benefits of preschool program attendance and especially to gauge progress toward the National Goals for Education (1994, 1998) that, by the year 2000 "every child will start school ready to learn." Such an evidence base is needed to better understand the types of early literacy skills that are affected by preschool and kindergarten programs. There is a need for more studies of preschool programs.

Research Studies Synthesized in the Analysis of Preschool and Kindergarten Interventions

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Ulrey, G. L., Alexander, K., Bender, B. & Gillis, H. (1982). Effects of length of school day on kindergarten school performance and parent satisfaction. *Psychology in the Schools*, *19*(2), 238–242.

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Appendix 6.A. Primary Coding of Preschool and Kindergarten Program Interventions with Oral Language and Reading Outcome Measures

Study	Type of Study[a]	Age[b]	SES[c]	Ethnic[d]	Population Density[e]
Banerji, M. (1988). Longitudinal effects of retention and promotion in kindergarten on academic achievement. *Florida Journal of Educational Research, 20*(1), 59–72.	2	2	2	1	3
Bergan, J. R., Sladeczek, I. E., & Schwarz, R. D. (1991). Effects of a measurement and planning system on kindergartners' cognitive development and educational programming. *American Educational Research Journal, 28*(3), 683–714.	2	2	1	4	2
Brown, V. (1992). Drama and sign language: A multisensory approach to the language acquisition of disadvantaged preschool children. *Youth Theatre Journal, 6*(3), 3–7.	2	1	1	4	3
Carlson, C. D., & Francis, D. J. (2002). Increasing the reading achievement of at-risk children through direct instruction: Evaluation of the Rodeo Institute for Teacher Excellence (RITE). *Journal of Education for Students Placed at Risk, 7*(2), 141–166.	1	2	—	4	3
Frazier, J. A., & Morrison, F. (1998). The influence of extended-year schooling on growth of achievement and perceived competence in early elementary school. *Child Development, 69*(2), 495–517.	2	2	—	4	1
Hurry, J., Sylva, K., & Riley, J. (1999). Evaluation of a focused literacy teaching programme in reception and year 1 classes: Child outcomes. *British Education Research Journal, 25*(5), 637–649.	2	1	—	4	3
Innocenti, M. S., Hollinger, P. D., Escobar, C. M., & White, K. R. (1993). The cost-effectiveness of adding one type of parent involvement to an early intervention program. *Early Education and Development, 4*(4), 306–326.	1	1	1	4	1
Jenkins, J. R., Odom, S. L., & Speltz, M. L. (1989). Effects of social integration on preschool children with handicaps. *Exceptional Children, 55*(5), 420–428.	2	1	—	4	3
Jenkins, J. R., Speltz, M. L., & Odom, S. L. (1985). Integrating normal and handicapped preschoolers: Effects on child development *and* social interaction. *Exceptional Children, 52*(1), 7–17.	2	1	—	1	3
McGill-Franzen, A., Yokoi, L., Brooks, G., & Allington, R. L. (1999). Putting books in the classroom seems necessary but not sufficient. *Journal of Educational Research, 93*(2), 67–74.	1	2	3	4	1

Oral Language[f]	Literacy Focus[g]	PD[h]	PI[i]	Mean ES for Primary Outcome Variables	
				Oral Language	Reading
—	2	2	2	—	0.27
—	2	2	2	—	0.04
2	2	2	2	0.42	—
—	1	1	2	—	2.90
1	2	2	2	—	0.37
1	1	1	2	–0.25	0.11
—	2	2	1	–0.03	—
2	2	2	2	0.09	—
—	2	2	2	–0.58	—
1	1	1	1	0.22	1.18

Study	Type of Study[a]	Age[b]	SES[c]	Ethnic[d]	Population Density[e]
Ramey, C. T., & Smith, B. J. (1976). Assessing the intellectual consequences of early intervention with high-risk infants. *American Journal of Mental Deficiency, 81*(4), 318–324.[j]	1	1	—	4	3
Roberts, J. E., Rabinowitch, S., Bryant, D. M., Burchinal, M. R., Koch, M. A., & Ramey, C. T. (1989). Language skills of children with different preschool experiences. *Journal of Speech & Hearing Research, 32*, 773–786.	1	1	1	2	3
Rodriguez, J. L., Diaz, R. M., & Espinoza, L. (1995). The impact of bilingual preschool education on the language development of Spanish-speaking children. *Early Childhood Research Quarterly, 10*, 475–490.	2	1	1	3	3
Shepard, L. A. & Smith, M. L. (1987). Effects of kindergarten retention at the end of first grade. *Psychology in the Schools, 24*, 346–357.	2	2	—	4	3
Sparrow, S. S., Blachman, B. A., & Chauncey, S. (1983). Diagnostic and prescriptive intervention in primary school education. *American Journal of Orthopsychiatry, 53*(4), 721–729.	2	2	1	4	3
Winsler, A., Diaz, R. M., Espinoza, L., & Rodriguez, J. L. (1999). When learning a second language does not mean losing the first: Bilingual language development in low-income, Spanish-speaking children attending bilingual preschool. *Child Development, 70*(2), 349–362.	2	1	1	4	1

[a] *RCT = 1, QED = 2.*
[b] *Preschool or younger = 1, kindergarten = 2.*
[c] *Low SES = 1, not low SES = 2, mixed SES = 3.*
[d] *Ethnicity: Caucasian = 1, African American = 2, Hispanic = 3, mixed = 4.*
[e] *Population density: Urban = 1, mixed = 2, unknown = 3.*
[f] *Vocabulary = 1, language composite = 2.*
[g] *Literacy focus = 1, not literacy focus = 2.*
[h] *PD = 1, not PD = 2.*
[i] *PI = 1, not PI = 2.*
[j] *Other reports of this study contributed values to the overall ESs (Campbell, Ramey, Pungello, Sparling & Miller-Johnson, 2002; Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001; Ramey, Campbell, & Ramey, 1999; Campbell & Ramey, 1995; Campbell & Ramey, 1994; Ramey & Campbell, 1984; Ramey & Gowen, 1984; Ramey, Yeates, & Short, 1984).*

Oral Language[f]	Literacy Focus[g]	PD[h]	PI[i]	Mean ES for Primary Outcome Variables	
				Oral Language	Reading
—	2	2	2	–0.03	0.56
2	2	2	1	0.07	—
2	2	2	2	0.38	—
—	2	2	2	—	0.46
1,2	1	2	2	0.86	0.85
1,2	2	2	2	0.43	—

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Campbell, F. A, Pungello, E., Miller-Johnson, S., Burchinal, M., & Ramey, C. T. (2001). The development of cognitive and academic abilities: Growth curves from an early childhood educational experiment. *Developmental Psychology, 37*(2), 231–242.

Campbell, F. A., Ramey, C. T., Pungello, E., Sparling, J., & Miller-Johnson, S. (2002). Early childhood education: Young adult outcomes from the Abdecedarian Project. *Applied Developmental Science*, *6*(1), 42–57.

Englemann, S., & Bruner, E. C. (1995). *The SRA reading mastery rainbow*. New York: McGraw-Hill.

Gilliam, W., & Zigler, E. (2000). A critical meta-analysis of all evaluations of state-funded preschool from 1977 to 1998: Implications for policy, service delivery and program evaluation. *Early Childhood Research Quarterly, 15,* 441–473.

Nelson, G., Westhues, A., & MacLeod, J. (2003). A meta-analysis of longitudinal research on prevention programs for children. *Prevention & Treatment*, *6(1),* 1–35.

Pezzino, J., & Lauritzen, V. (1986). *Parents involved in education: A guide for the trainers of parents of young handicapped children.* Logan, UT: Utah State University.

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Chapter 7

IMPACT OF LANGUAGE-ENHANCEMENT INTERVENTIONS ON YOUNG CHILDREN'S EARLY LITERACY SKILLS

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Introduction

The National Early Literacy Panel (NELP) found that enhanced language learning should be a valued outcome when evaluating literacy-improvement efforts for young children. Of course, improvements in language learning may result incidentally from any early learning interventions (and those improvements are considered in the other chapters), but this chapter looks specifically at the effectiveness of interventions designed to explicitly and directly improve young children's language skills, in terms of vocabulary development, syntactic sophistication, listening comprehension, and other similar aspects of language development.

Three main questions are explored in this part of NELP's report:

1. Did language-enhancement programs improve early literacy learning outcomes, including early learning outcomes important to later school-age reading?
2. Did children's demographic characteristics (e.g., socioeconomic status [SES], age, race) moderate the effects of a language-enhancement instruction?
3. Were some kinds of language-enhancement instruction more effective than others? That is, were particular programs or implementation characteristics related to effectiveness?

Description of the Language-Enhancement Studies

The studies of language-enhancement interventions used various outcome measures to evaluate the effectiveness of these approaches. All of these studies included some measure of oral language development—most often a vocabulary measure—while others evaluated the effects

of language-enhancement efforts on phonemic awareness; cognitive ability; decoding; memory; print knowledge; rapid automatic naming (RAN); general readiness; and reading. No studies evaluated alphabet knowledge (AK), spelling, visual motor skills, or writing. Although these studies considered many different learning outcomes, there were usually too few studies to allow for analysis of the overall impact of language interventions on these variables (there had to be three studies that measured a particular construct to allow the results to be meta-analyzed). Table 7.1 includes the average effect sizes (ESs) presented in alphabetical order, numbers of studies, and significance of the interventions on the various outcomes.

Table 7.1. Estimates of Effect Sizes Across Outcome Domains for Language-Enhancement Interventions

Dependent Variable	Fixed ES	Random ES	95% CI		*N* of Studies	*p* for ES
			Lower Bound	Upper Bound		
Cognitive ability	0.85	0.85	0.27	1.42	1	0.004
Oral language	0.61	0.63	0.42	0.84	19	0.0001
PA	0.55	0.57	0.01	1.14	2	0.05
Print knowledge	0.81	0.81	0.20	1.41	1	0.009
RAN	0.54	0.54	–0.05	1.13	1	0.075
Readiness	0.62	0.62	0.08	1.16	1	0.024
Reading	0.20	0.36	–0.38	1.10	2	0.343

Note: CI = CI based on random-effect model.

To be included in the analyses reported in this chapter, studies had to consider the effectiveness of some instructional effort implemented to improve young children's language ability and skills. The studies included here had to meet a priori criteria that the panel established. The studies had to be carried out with children from birth through age 5 (or kindergarten) and had to use a group design, meaning that it compares the outcomes of an intervention with the results obtained from a comparison or control group. The comparison condition would include a group of children who were receiving no service or teaching beyond that routinely or traditionally used by the school or early childhood program, or an alternate treatment, while the experimental condition would have received the language-enhancement intervention.

This design could be an experiment (meaning that the children were randomly assigned to the instruction) or a quasiexperiment (meaning that intact groups were assigned to the treatments; when this approach was taken, the study had to provide evidence that these groups were actually equal at the beginning of the study). A comparison of the experimental (randomized control trial [RCT]) versus quasiexperimental design (QED) studies in this category resulted in no differences in treatment effectiveness as a function of study design ($Q[1,17] = 0.09$, $p = 0.76$) (see Table 7.2). The studies had to provide a description of what was actually implemented with the children. Experiments of short-term trials, such as a single lesson, were excluded. Finally, the study had to measure the effects of the language-enhancement program with valid, reliable instruments that assessed children's early literacy or language skills.

Table 7.2. Effect Sizes for Oral Language Outcomes Based on Type of Study Design

Study Design	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
RCT	0.65	0.15	0.35	0.94	4.27	9	0.0005
QED	0.59	0.12	0.35	0.82	4.89	10	0.0001

Nineteen studies were identified for inclusion in the analysis of the effectiveness of language-enhancement instruction. Forty-seven percent of the studies were published in the last decade, 32 percent in the 1980s, and 21 percent in the 1970s. Researchers, teachers, parents, or others carried out these interventions in a variety of contexts (e.g., home, classroom, center). The interventions were short or long term, of varying intensity, and with few or many children, and included typically developing children as well as children with an array of language difficulties.

The 19 studies varied considerably in outcomes measured, intervention durations, and ages of the children. About 70 percent of the studies included preschoolers or kindergarten children, with the rest considering the language growth of infants and toddlers (only one study included infants below one year of age). About half of the studies involved a relatively short intervention (less than 10 weeks), and, of those with longer interventions, the length was still usually no more than a few months, with a couple lasting for an entire school year. About 40 percent of the studies focused on children with language and learning delays. The sample size of the groups under study was often small, with fewer than 20 children (58 percent), and never exceeded 30 children in each group. Most of the studies used random assignment of children to conditions (68 percent), with outcomes measured soon after the end of the intervention (79 percent). Only four of the 19 studies evaluated sustained effects at some later point after the completion of the intervention. The person administering the intervention ranged from a researcher or clinician (53 percent of the studies) to teachers (26 percent) or parents (16 percent), and, in one study, a computer administered the intervention.

To measure the interventions' effectiveness on children's learning, a broad range of outcomes was included in these 19 studies. These are summarized in Table 7.3.

Table 7.3. Distribution of Outcome Measures Used in 19 Language-Enhancement Studies

Outcome Assessments	Percentage of Studies
Language output (e.g., mean length of utterance, frequency of word use)	15
Gains in specific words or grammatical structures	10
Composite language scores	26
Complexity of multiword utterances	26
Listening comprehension	16
Literacy outcomes	15

There was a great deal of variability across the 19 studies in the type of intervention implemented. In general, interventions differed on such factors as amount of direction or

structure provided, the social context of the intervention, feedback to the child, and the type of language skill targeted for change. A typical intervention evaluated here might be referred to as focused-stimulation interventions (26 percent). These were usually conducted within a naturalistic context in which the child heard specified language input (e.g., vocabulary, question types) often in game-like or play activities within their daily routines. Another frequent approach had children engaged in language activities, such as responding to *wh* questions or talking about similarities and differences in pictures (21 percent). Two other categories of language interventions were similar in the direct training of components of language, such as phonology (16 percent) or sentence structure (16 percent). Some studies did not easily fit into any of these categories. For example, only single studies examined the following approaches: the use of computer feedback to train vocabulary; building language through motor exercises; and building listening comprehension through exposure to stories read aloud.

Do Language-Enhancement Interventions Improve Children's Language and Literacy Learning?

The studies that looked at oral language development outcomes were grouped into three overlapping clusters for analysis. The first cluster, *general oral language enhancement*, included any measures of oral language, and this cluster included all 19 studies. A second cluster of eight studies, *language composite*, was drawn from these 19 studies and looked at composite or general measures of oral language development. Finally, a third group of 10 studies, *oral language* (vocabulary enhancement), focused specifically on vocabulary improvement alone.

General Oral Language Enhancement as a Function of Language Intervention

These 19 studies attempted to improve young children's performance on a wide variety of oral language outcomes, including expressive or receptive vocabulary skills and grammatical development. The interventions were delivered in differing ways but usually in a small-group format. Parents, teachers, graduate trainees, speech-language clinicians, or trained home visitors delivered the interventions. These interventions were varied and included efforts to teach specific words, phonology, or morphosyntax, incidental teaching, enriched play experiences, and encouragement of creative thinking. Children with and without language problems were included, as were gifted kindergarten children and children in low- and middle-income families.

The evaluation of language-enhancement interventions across these 19 studies showed that such interventions successfully improved children's oral language development. The average ES for these 19 studies is 0.63 (using a random-effect model) ($Q[1,17] = 1.08$, $p = 0.30$), which is considered to be a moderate-sized effect.

Oral Language (Language Composite) Enhancement as a Function of Language Intervention

Eight studies contributed to the analysis of a mixed set of language outcomes (hence the term *language composite*). Among these, children with language delays or atypical communication skills were included in four of the studies, and toddlers or preschoolers were included as subjects in six of the studies. The interventions varied considerably, from focused or direct

training methods to training contextualized in adult-child interactive play or storybook-reading sessions to a motor-skill or physical-education context to which enriched language was added. For example, an interactive, child-centered stimulation program delivered by speech-language pathologists and focusing on vocabulary expansion and two- and three-word combinations was the enhancement delivered in one study of late-talking 21- to 30-month-olds. In a second study of children with language delays or deviant communication skills, adult-child dyads with carefully scripted adult roles moved from imitation of child play toward more mature cooperative interactions, thus promoting an interpersonal context for communication instead of one directed more pointedly at speech production and comprehension. The comparison group received a more traditional, language-focused intervention. A third study provided language-enhanced physical-education activities for the treatment group, while the comparison group engaged in physical-education activities without language enhancement, with children in special education, typical prekindergarten and Head Start prekindergarten classes, in 24 sessions in an eight-week time frame. Yet another study varied instructional-unit size for kindergartners in the training of listening comprehension, using story reading in each intervention session, and comparing 1:1, 1:7, and 1:15 teacher-to-child ratios. Although diverse in their intervention methods, agents, target areas of language enhancement, and rationales, the studies share the characteristic of casting a rather broad net of assessments as outcomes of interest. Virtually all of the studies were conducted in a center-based or school-based context, with the exception of one reporting that the enhancement sessions took place uniformly in one locale for each child, either at the child's preschool or at home. The evaluation of language enhancement versus control across these eight studies yielded a significant result for the dependent measure, oral language (language composite) ($Q[1,6] = 14.25104$, $p = 0.046$). It is therefore worthwhile to report the measures represented in the composite group. These included measures of expressive vocabulary, oral language, verbal IQ, listening comprehension, language skills (not otherwise specified), phonemic awareness, concept of word, memory, oral-expression composite, RAN graphological and RAN nongraphological, reading comprehension, and visual motor skill.

Oral Language (vocabulary enhancement) as a Function of Language Intervention

The 10 studies included in this cluster were an array of language enhancements, usually delivered in small-group format in several sessions over several weeks, and almost all guided by teachers, graduate trainees, or speech-language clinicians. Two of the studies used parents as interventionists, and one employed computer-based training of vocabulary. The focus of language enhancement ranged from specific target-word learning to incidental teaching to encouragement of enriched play experiences or enhancement of creative thinking to training via phonological intervention or morphosyntax intervention. The oral language and vocabulary outcomes included expressive or receptive vocabulary skills and additional oral language abilities. Children with and without language problems were sampled in the mix of 10 studies, as were gifted kindergartners. The evaluation of language enhancement versus control across the 10 studies yielded a nonsignificant result for the dependent measure, oral language–vocabulary ($Q[1,8] = 5.55$, $p = 0.70$). Again, this finding is limited by the strict inclusion criteria applied to all studies examined in the NELP report and by the intervention versus no-treatment comparison methodology required for this analysis. See Table 7.4 for a comparison of outcomes by type of language measure used (simple vocabulary measures versus composite measures of language).

Table 7.4. Effect Sizes of Oral Language Interventions on Measures of Simple Vocabulary and Composite Measures of Oral Language

Measures	Mean ES	SE	95% CI		*t*	*N*[a]	*p*
			Lower Bound	Upper Bound			
Vocabulary	0.54	0.13	0.28	0.79	4.14	10	< 0.0002
Composite	0.80	0.22	0.37	1.22	3.68	8	< 0.0002

[a] *One of the 19 studies included in this analysis contributed both measure and is reflected in the total n.*

Even though it is impossible to provide further analysis of those outcome measures that were used in fewer than three studies, it is important to note that various non-oral language outcomes were examined in several studies and often with good results. For example, two studies considered the impact of oral language interventions on children's phonological awareness (PA) and found significant improvement. Similarly, there were significant and sizable gains evident in individual studies that considered cognitive ability, print knowledge, and reading readiness. With more language-intervention studies that include these types of outcome measures in the future, it will be possible to determine whether other aspects of literacy-related learning are enhanced.

Which Children Benefited from These Language-Enhancement Interventions?

Language-enhancement interventions improved children's language development, but some children may have benefited more than others from such interventions. The demographic information drawn from these studies was used to determine whether the results differed across groups of children. The demographic features that could be considered were age (Q(1,17) = 1.08, p=.30), ethnicity (Q[1,17] = 0.47, p = 0.49), SES (Q[2,7] = 3.40, p = 0.18), and population density (Q[3,15] = 0.04, p = 0.99). Tables 7.5, 7.6, 7.7, and 7.8 summarize these results and show that ES estimates did not differ significantly between groups for any of these demographic categories.

Table 7.5. Effect Sizes for Oral Language Outcome for Language-Enhancement Interventions Based on Age of Children in Study Sample

Age	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Prekindergarten	0.71	0.13	0.45	0.96	5.37	13	0.00001
Kindergarten	0.51	0.14	0.25	0.78	3.78	6	0.002

Table 7.6. Effect Sizes for Oral Language Outcome for Language-Enhancement Intervention Based on Ethnicity of Children in Study

Race or Ethnicity	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
African American	0.42	0.30	–0.17	1.00	1.40	2	0.18
Mixed or unknown	0.63	0.10	0.44	0.83	6.37	17	< 0.00002

Table 7.7. Effect Sizes for Oral Language Outcome for Language-Enhancement Interventions Based on Socioeconomic Status of Study

SES	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Low	0.36	0.25	–0.13	0.85	1.42	3	0.20
Not low	0.93	0.21	0.52	1.34	4.42	5	0.003
Mixed	0.48	0.36	–0.11	1.18	1.34	2	0.22

Table 7.8. Effect Sizes for Oral Language Outcome for Language-Enhancement Interventions Based on Population Density of Study Sample

Population Density	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Rural	0.62	0.26	0.10	1.13	2.35	2	0.033
Urban	0.62	0.17	0.29	0.95	3.71	6	0.002
Suburban	0.54	0.39	–0.21	1.30	1.40	1	0.181
Unknown	0.61	0.13	0.35	0.88	4.56	10	0.0004

It should be noted, however, that there were serious limitations to these analyses. For instance, two of the studies focused on African American children, while the other 17 studies considered mixed groups of children or failed to provide information about ethnicity. Similarly, nine of the studies did not report adequate data to categorize SES. It is possible that there would be differences in the effectiveness of these kinds of interventions for different types of children, but this has not been reported or explored in the original studies enough to allow for a convincing and reliable determination of this at this time.

Were Particular Types of Language-Enhancement Interventions More Successful Than Others?

By analyzing specific characteristics in the interventions examined in the original studies and linking these characteristics to the ESs for those studies, it is possible to determine whether there are particular types of interventions that will be more successful than others. The identification of these intervention differences is limited by the adequacy of the descriptions of the interventions in the 19 studies. In addition, the studies frequently overlapped when grouping for these characteristics, making it difficult to determine independent effects of the interventions with the various outcomes.

Are Interventions That Target Children Younger Than Three Years Old More Effective Than Those with Older Children?

Four intervention studies tested the effectiveness of a language intervention for children younger than three years old; three included toddlers (25.6 to 31 months), and one targeted infants (9–15 months). These four interventions varied somewhat, but all were toy centered, three

were child directed with an emphasis on giving language stimulation in response to the child's interest, and the one with infants involved provision of different approaches to encourage vocal sound and word approximations. The four interventions ranged in duration from one to three months and so were relatively brief in nature. These four studies were contrasted with the other 15 interventions that had targeted children older than three years of age (range 3.5 to five years). These 15 interventions also varied greatly on many dimensions (e.g., duration, intervention approach, person providing the intervention). Significant differences were found between the two groups of studies (Q [1,17] = 3.74, $p < 0.05$) with greater effectiveness found for the interventions that included children younger than three years of age. These results suggest that intervening earlier versus later is advantageous for enhancing children's language development. Table 7.9 summarizes the results of this comparison.

Table 7.9. Effect Sizes for Oral Language Outcome for Language-Enhancement Interventions Based on Age of Children in Study Sample

Age	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Prekindergarten	0.54	0.10	0.34	0.74	5.32	15	< 0.0001
Birth to three years	1.07	0.26	0.57	1.58	4.18	4	0.0006

Do Interventions That Are Play-Based Provide Superior Results over Those Contextualized in Other Types of Learning Settings?

The comparison of studies in which the intervention was more fully seated in a play-based activity with studies in which the intervention was not particularly play based did not result in significantly different outcomes (Q[1,15] = 0.24, p = 0.63). Six of the studies focused on interventions that were based in play activities, while 11 of the studies used other types of learning settings. Studies included in the play-based interventions were those that had toys available for the child and opportunities for the child to engage with toys in ways that he or she chose. For example, one intervention situated the language-enrichment exposure in physical-activity sessions in preschool, one used an adult play tutor to facilitate language enrichment during play, and, for one study, a toy demonstrator modeled rich verbal-stimulation techniques for the parent in demonstrating interactive play with the child at home. The nonplay interventions may or may not have included toys but did not allow the child to engage with toys on his or her own. For example, in one of these nonplay interventions, vocabulary training was done through computer story exposure and follow-up interactive computer games, while another used training conducted by teachers in generating questions. Two of the 19 studies were excluded from this analysis because there was not enough information to determine whether the intervention fit better as a play-based intervention. Table 7.10 summarizes the results of this comparison.

Table 7.10. Effect Sizes for Oral Language Outcome for Language-Enhancement Interventions Based on Whether the Intervention Was Play Based

Play Based	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
No	0.54	0.12	0.32	0.78	4.71	11	0.000
Yes	0.65	0.18	0.30	1.01	3.57	6	0.002

Does the Intervention's Effectiveness Vary as a Function of the Language Status of the Children in the Study?

Among the 19 studies, five included samples of children with language impairment, and five included samples of children with typically developing language skills for age (see Table 7.11). The other nine studies included a mixed sample of children or the language status of the children was not indicated, so these studies were excluded from this analysis. The types of impairments differed in the affected samples; for example, one study included a sample with expressive-vocabulary delay, another focused on children with delay in grammatical development, and one study included both speech and language impairments. No significant difference was found in intervention effectiveness as a function of the language status of the samples studied ($Q[1,8] = 1.52$, $p = 0.22$).

Table 7.11. Effect Sizes for Oral Language Outcome for Language-Enhancement Interventions Based on Language Status of the Children in the Study Sample

Language Impairment	Mean ES	SE	95% CI		*t*	*p*	*n*
			Lower Bound	Upper Bound			
No	0.52	0.16	0.21	0.85	3.21	0.012	5
Yes	0.83	0.46	0.46	1.20	4.40	0.002	5

Does the Effectiveness of Language Interventions Depend on the Agent (e.g., teacher, parent, computer) Who Delivers It?

There were inadequate numbers of studies to make comparisons with regard to intervention agents. It was not possible, for instance, to determine whether teachers were as effective as speech-language pathologists. Some studies involved both parent and professionals as agents of intervention. However, there were adequate numbers of studies to compare teachers to parents. Three of the studies used teachers as interventionists, while four used parents. All three of the teacher-interventionist studies took place in kindergartens, without particular note of language delay or impairment in the samples studied; two of these included explicit teacher training in the program package or method of question generation that was the target of intervention. In the third, preservice teachers conducted the intervention sessions by reading prepared stories and

instructions for the questions asked about the stories. In contrast to the studies using teachers as agents of intervention, those that employed parents as interventionists included children both at and younger than kindergarten age, with half of the four studies including samples of children with language difficulties or delays. The comparison between intervention agents—teacher versus parent—yielded no significant difference in outcomes ($Q[1,5] = 0.42$, $p = 0.52$). It did not seem to matter who delivered the interventions, as children benefited in either case. Again, the small study set in this contrast limits its utility, as does the marked differences in the types of interventions being implemented by teacher versus parent as agent. Table 7.12 includes a summary of the results of this comparison.

Table 7.12. Effect Sizes for Oral Language Outcome for Language-Enhancement Interventions Based on Agent of Intervention

Agent	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
Parent	0.64	0.21	0.21	1.05	2.96	4	0.032
Teacher	0.83	0.22	0.41	1.25	3.85	3	0.012

Are Interventions That Are Structured Such That Feedback Is Given to the Child After He or She Responds More Effective Than Those That Do Not Provide Feedback?

This question was possible to address because four of the intervention studies were similar in terms of providing some form of feedback to a child based on the type of response the child gave. These four studies were contrasted with eight intervention studies that did not give any form of systematic feedback following a child's response. The other seven studies were excluded from this analysis because the interventions were not of the type in which feedback would be provided or it was not possible to determine whether feedback was given as a part of the intervention. This comparison was of interest because feedback might improve the child's learning of the language concept. No significant differences were found in intervention effectiveness as a function of the provision of feedback following a child response ($Q[1,10] = 0.009$, $p = 0.92$). Table 7.13 gives a summary of the results of this comparison. This result needs to be interpreted with a great deal of caution, as only four studies could be included in the provision-of-feedback category. Also, while these four studies were similar in providing feedback, the conditions under which feedback was provided and the type of feedback provided varied considerably. Thus, a more stringent test of this question would include more studies investigating the effectiveness of interventions that used very similar approaches in the provision of feedback following a child's language response.

In general, all four were designed such that the person giving the intervention was trained to provide further questioning (one versus multiple questions) or, in one study, a hint or cue to guide the child to make a correct response if he or she gave an incorrect response. One of the four studies had a highly structured teacher-directed approach and targeted a broad range of language skills across a full school year. In contrast, the other three targeted more specific areas of language development for one to four months. Two of these three promoted questioning skills,

one in a structured format with emphasis on repetition of modeled questions and one with a more naturalistic, object-centered approach. The third targeted receptive vocabulary development with a computer delivering the intervention. The eight contrast interventions used a child-centered approach in which the adult providing the intervention gave enriched language input in reciprocal interactions. In all but one study, language stimulation was provided in the context of interactions centered on toys or pictures. In one study, language stimulation was provided in the context of physical activity.

Table 7.13. Effect Sizes for Oral Language Outcome for Language-Enhancement Interventions Based on Type of Feedback Provided to the Child

Type of Feedback	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
No feedback	0.63	0.17	0.30	0.96	3.74	8	0.004
Feedback	0.66	0.22	0.23	1.09	3.01	4	0.013

Are Interventions That Require a Child to Respond More Effective Than Those That Do Not Have This Requirement?

Seven intervention studies were designed to require a child receiving the intervention to provide a response. In all seven studies, the child was required to respond in a range of ways, such as (1) answer a question (e.g., "What is this called?" while the interventionist points to or shows a picture or object), (2) repeat a modeled utterance, (3) describe characteristics of objects or ask questions about them, or (4) provide the name of a toy after hearing its name. Thus, for all seven of these interventions, the interventionist provided a certain degree of structure that might be expected to facilitate greater language learning. The seven studies varied on the length of the intervention. Three lasted about one month (four weekly sessions). Of the remaining four, two lasted four months and two lasted the full school year. Five were carried out with five-year-olds, and two interventions targeted two- and three-year-olds.

Six intervention studies that did not require a child to give a response were contrasted with the seven studies that did. All six of these were also included as part of the eight studies in the previous section that did not provide feedback to a child's response. In addition, six other studies could not be included in this analysis because descriptions of the interventions lacked sufficient information to determine whether the child was required to give a response or the interventions were of a different focus. The six interventions not requiring a response were child centered and toy or activity based (e.g., games, physical movement), and the interventionist followed the child's lead without systematically requesting a response. Four included preschool-age children, and two conducted the intervention with two-year-olds. The length of the interventions ranged from three to seven months. When these two groups of studies were examined for differences in effectiveness, no significant differences were found ($Q[1,11] = 0.35$, $p = 0.56$). Table 14 summarizes the results of this comparison.

Table 7.14. Effect Sizes for Oral Language Outcome for Language-Enhancement Interventions Based on Required Child Response

Response	Mean ES	SE	95% CI		*t*	*n*	*p*
			Lower Bound	Upper Bound			
None	0.68	0.19	0.32	1.05	3.66	6	0.004
Given	0.55	0.14	0.27	0.82	3.85	7	0.003

Summary and Conclusions

Interventions designed to improve young children's oral language skills have been effective. These interventions enhance oral language when it is defined as a diverse set of outcomes, such as expressive and receptive language skills, phonemic awareness, and verbal intelligence.

It might be expected that oral language–enhancement interventions would work better with children who struggle with language or have some form of language impairment, but these analyses suggest this not to be the case, though differences might emerge from a larger sample of studies. Apparently, language-enhancement interventions provide a useful support to a broad range of children, including those with normal language functioning. Similarly, there were no differences in the effectiveness of these interventions for children on the basis of their SES, ethnicity, or the population density of where they live.

The one difference that did seem to matter in the effectiveness of language-enhancement interventions concerned the children's ages. Older children, between three and five years of age, did not get as big a language boost from these interventions as did the younger children. It would appear that intervening earlier rather than later is advantageous, although the exact process of this impact is not addressed here.

Similarly, there seemed to be no key features to these interventions that consistently gave an advantage. All of these programs seemed to work. In fact, of the 19 studies, 18 had individual outcome effects that were moderate to large.

There is a set of questions of both pressing practical significance and enormous theoretical importance that could not be addressed in these analyses. These are challenging questions that, if answered, would inform the field about teaching materials or strategies that provide maximum benefit for children's language growth in the birth-to–five-year-old age range. For example, beyond the age-related results discussed in the preceding section, it would be useful to delineate successful approaches to language enhancement by age, slicing the age variable into more narrowly defined periods of one- to two-year intervals or evaluating a broader range of interventions by age. School and day-care settings often separate age groups in the birth-to-five-year-old population, making difficult the generalization of language-intervention findings obtained with the oldest children to the youngest. The lack of adequate numbers of studies for meaningful comparisons blocked analysis of this variable. Several other questions deserving of careful attention could not be addressed because a critical number of studies that met the criteria

to be included in the research synthesis was lacking or because information that would guide specific contrasts was missing. Among those questions are the following:

- Is there benefit to the adoption of specific approaches to teaching in language interventions (e.g., direct instruction versus naturalistic or milieu-based interventions)?
- Can we comment on the effectiveness of specific curricula developed for the birth-to–five-year-old population (e.g., computer software–based curricula, commercially available curricula with instruction delivered through teachers and curricular materials, researcher-mounted curricula delivered through teachers, parents, or researchers)?
- Is there information on best practices for delivering language interventions for specific populations of children (e.g., children with language impairments, children who are English-language (or whatever the language of school instruction is) learners, children in low-income families)?
- Does success vary as a function of the agent of intervention (e.g., researchers, speech-language pathologists, other professionals)?
- Does outcome differ with the intensity of the intervention (e.g., frequency of applications per week, group size, group versus individual training)?
- How shall we conceptualize the interaction of intervention strategy, frequency of application, and age group?

Considerations for Future Research

One of the most important outcomes of this endeavor is the identification of research areas that need much more attention that are related to the efficacy of language interventions for young children. The following six areas of research are suggested as a starting point for generating a better understanding of what interventions work and for which children, as well as the aspects of early language and literacy development that they enhance:

- examinations of language curricula and programs addressing the ages at which they are most effective. These studies need to be conceptually guided and include a range of outcomes that the intervention might affect.
- more replication studies of the interventions that show positive effects. These studies need to expand the cohorts of children studied in the original interventions to provide information on the intervention's generalizability to the broadest range of children. Attention also needs to be given to such issues as intensity and agent of the intervention and training methods for those administering the intervention.
- attention to large cohort studies that examine programs that might show efficacy in enhancing specific aspects of language development. These include expressive and receptive language for vocabulary, syntax, semantics, and pragmatic skills.
- attention to the need for a more unifying terminology of characteristics of children at risk for language problems and those identified as language impaired. This research needs

to demonstrate how well-specified, evidence-based programs can address the language needs of different groups of children at risk.

- more longitudinal research that provides information on the sustainability of the effectiveness of intervention programs.

The importance of addressing these questions is clear, and the information we lack precludes making careful and precise statements to guide practice. While an unsatisfying conclusion, this is nonetheless a highly pertinent one; gaps in systematically collected data (that is, the studies meeting criteria for the evaluation of language interventions) leave us with only a sketchy response to extremely important curricular and intervention questions. There is clearly a need to prioritize research that can both guide practice and provide evidence-based options for the field.

In light of the high prevalence of language delays and impairments identified in young children, as well as the needs of children who are English-language learners, this report highlights the need for a great deal more research in these areas. Current findings are often based on small samples of children, and, too often, the studies are not rigorously described. More research is needed using rigorously implemented and described experimental interventions, with sample sizes and sample characteristics that would facilitate generalization. It is noteworthy that only one study provided a longitudinal follow-up component that could help ensure that the program's effects could sustain. There is evidence from the language-intervention studies examined in this report that addressing children's language needs at earlier rather than later ages provides better results. Thus, it is imperative that we identify the enhancement approaches that teachers, parents, and clinicians need in order to give children the best opportunity to enter schools with the language skills they need to succeed.

Research Studies Synthesized in the Analysis of Language-Enhancement Interventions

Asbury, C. A. (1970). Section C: Some effects of training on verbal mental functioning in Negro pre-school children: A research note. *Journal of Negro Education*, *39*(1), 100–103.

Benner, G. J., Trout, A., Nordness, P. D., Nelson, J. R., Epstein, M. H., Knobel, M.-L., et al. (2002). The effects of the Language for Learning program on the receptive language skills of kindergarten children. *Journal of Direct Instruction*, *2*(2), 67–74.

Beveridge, M., & Jerrams, A. (1981). Parental involvement in language development: An evaluation of a school-based parental assistance plan. *British Journal of Educational Psychology*, *51*(3), 259–269.

Cassidy, A. M., & Vukelich, C. (1997). The effects of group size on kindergarten children's listening comprehension performance. *Psychology in the Schools*, *14*(4), 449–455.

Christie, J. (1983). The effects of play tutoring on young children's cognitive performance. *Journal of Educational Research*, *76*(6), 326–330.

Cole, K. N., & Dale, P. S. (1986). Direct language instruction and interactive language instruction with language delayed preschool children: A comparison study. *Journal of Speech & Hearing Research*, *29*(2), 206–217.

Cole, K. N., Dale, P. S., & Mills, P. E. (1991). Individual differences in language delayed children's responses to direct and interactive preschool instruction. *Topics in Early Childhood Special Education*, *11*(1), 99–124.

Cole, K. N., Mills, P. E., Dale, P. S., & Jenkins, J. R. (1996). Preschool language facilitation methods and child characteristics. *Journal of Early Intervention*, *20*(2), 113–131.

Connor-Kuntz, F. J., & Dummer, G. M. (1996). Teaching across the curriculum: Language-enriched physical education for preschool children. *Adapted Physical Activity Quarterly*, *13*(3), 302–315.

Fey, M. E., Cleave, P. L., Long, S. H., & Hughes, D. L. (1993). Two approaches to the facilitation of grammar in children with language impairment: An experimental evaluation. *Journal of Speech & Hearing Research, 36*(1), 141–157.

Fey, M. E., Cleave, P. L., Ravida, A. I., Long, S. H., Dejmal, A. E., & Easton, D. L. (1994). Effects of grammar facilitation on the phonological performance of children with speech and language impairments. *Journal of Speech & Hearing Research, 37*(3), 594–607.

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Girolametto, L., Pearce, P. S., & Weitzman, E. (1996). Interactive focused stimulation for toddlers with expressive vocabulary delays. *Journal of Speech & Hearing Research, 39*(6), 1274–1283.

Glaubman, R., Glaubman, H., & Ofir, L. (1997). Effects of self-directed learning, story comprehension, and self-questioning in kindergarten. *Journal of Educational Research*, *90*(6), 361–374.

Hamilton, M. L. (1977). Social learning and the transition from babbling to initial words. *Journal of Genetic Psychology*, *130*(2), 211–220.

Holobow, N. E., Genesee, F., & Lambert, W. E. (1991). The effectiveness of a foreign language immersion program for children from different ethnic and social class backgrounds: Report 2. *Applied Psycholinguistics*, *12*(2), 179–198.

Korkman, M., & Peltoman, A. K. (1993). Preventive treatment of dyslexia by a preschool training program for children with language impairments. *Journal of Clinical Child Psychology*, *22*(2), 277–287.

Levenstein, P. (1970). Cognitive growth in preschoolers through verbal interaction with mothers. *American Journal of Orthopsychiatry*, *40*(3), 426–432.

Meador, K. S. (1994). The effect of synectics training on gifted and nongifted kindergarten students. *Journal for the Education of the Gifted, 18*(1), 55–73.

Robertson, S. B., & Weismer, S. E. (1999). Effects of treatment on linguistic and social skills in toddlers with delayed language development. *Journal of Speech, Language, and Hearing Research*, *42*(5), 1234–1248.

Segers, E., & Verhoeven, L. (2003). Effects of vocabulary training by computer in kindergarten. *Journal of Computer Assisted Learning, 19*(4), 557–566.

Seifert, H., & Schwarz, I. (1991). Treatment effectiveness of large group basic concept instruction with Head Start students. *Language, Speech, and Hearing Services in Schools*, *22*(2), 60–64.

Smith, C., & Fluck, M. (2000). (Re-)constructing pre-linguistic interpersonal processes to promote language development in young children with deviant or delayed communication skills. *British Journal of Educational Psychology*, *70*(3), 369–389.

Tyler, A. A., Lewis, K. E., Haskill, A., & Tolbert, L. C. (2003). Outcomes of different speech and language goal attack strategies. *Journal of Speech, Language, and Hearing Research, 46*(5), 1077–1094.

Valdez-Menchaca, M. C., & Whitehurst, G. J. (1988). The effects of incidental teaching on vocabulary acquisition by young children. *Child Development*, *59*(6), 1451–1459.

Valian, V., & Casey, L. (2003). Young children's acquisition of *wh*-questions: The role of structured input. *Journal of Child Language*, *30*(1), 117–143.

Ward, S. (1999). An investigation into the effectiveness of an early intervention method for delayed language development in young children. *International Journal of Language & Communication Disorders*, *34*(3), 243–264.

Yoder, P. J., Kaiser, A. P., Goldstein, H., Alpert, C., Mousetis, L., Kaczmarek, L, et al.] (1995). An exploratory comparison of milieu teaching and responsive interaction in classroom applications. *Journal of Early Intervention*, *19*(3), 218–242.

Appendix 7.A. Primary Coding of Studies with Oral Language Outcome Measures

Study	Type of Study[a]	Age[b]	SES[c]	Ethnic[d]	Population Density[e]
Asbury, C. (1970). Section C: Some effects of training on verbal mental functioning in Negro pre-school children: A research note. *Journal of Negro Education, 39*(1), 100–103.	1	1	2	1	4
Benner, G. J., Trout, A, Nordness, P. D., Nelson, J. R., Epstein, M. H., Knobel, M., Epstein, A., et al. (2002). The effects of the Language for Learning program on the receptive language skills of kindergarten children. *Journal of Direct Instruction, 2*(2), 67–74.	2	2	—	2	1
Beveridge, M., & Jerrams, A. (1981). Parental involvement in language development: An evaluation of a school-based parental assistance plan. *British Journal of Educational Psychology, 51*(3), 259–269.	2	1	1	2	2
Cassidy, A. M., & Vukelich, C. (1977). The effects of group size on kindergarten children's listening comprehension performance. *Psychology in the Schools, 14*(4), 449–455.	1	2	—	2	3
Christie, J. F. (1983). The effects of play tutoring on young children's cognitive performance. *Journal of Educational Research, 76*(6), 326–330.	1	1	1	2	1
Connor-Kuntz, F. J., & Dummer, G. M. (1996). Teaching across the curriculum: Language-enriched physical education for preschool children. *Adapted Physical Activity Quarterly, 13*, 302–315.	1	1	3	2	4
Fey, M. E., Cleave, P. L., Long, S. H., & Hughes, D. L. (1993). Two approaches to the facilitation of grammar in children with language impairment: An experimental evaluation. *Journal of Speech & Hearing Research, 36*, 141–157.	1	1	—	2	4
Girolametto, L., Pearce, P. S., & Weitzman, E. (1996). Interactive focused stimulation for toddlers with expressive vocabulary delays. *Journal of Speech and Hearing Research, 39*, 1274–1283.	1	1	2	2	2
Glaubman, H., Glaubman, R., & Ofir, L. (1997). Effects of self-directed learning, story comprehension, and self-questioning in kindergarten. *Journal of Educational Research, 90*(6), 361–374.	1	2	2	2	2
Hamilton, M. (1977). Social learning and the transition from babbling to initial words. *Journal of Genetic Psychology, 130*, 211–220.	2	1	3	2	2

Oral Language[f]	Age 0–3[g]	Play[h]	Language Status[i]	Agent[j]	Feedback[k]	Response[l]	Mean ES
—	2	2	—	—	—	—	0.42
1	2	2	2	1	1	1	0.81
1	2	2	—	2	—	—	0.46
2	2	2	2	1	—	—	0.54
1	2	1	2	—	2	2	0.14
2	2	1	—	—	2	2	0.13
2	2	—	1	2	—	—	0.88
1	1	1	1	2	2	2	0.86
2	2	2	—	1	1	1	1.31
—	1	2	—	—	—	—	2.05

Study	Type of Study[a]	Age[b]	SES[c]	Ethnic[d]	Population Density[e]
Korkman, M. (1993). Preventive treatment of dyslexia by a preschool training program for children with language impairments. *Journal of Clinical Child Psychology, 22*(2), 277–287.	2	2	—	2	4
Levenstein, P. (1970). Cognitive growth in preschoolers through verbal interaction with mothers. *American Journal of Orthopsychiatry, 40*(3), 426–432.	2	1	1	1	2
Meador, K. S. (1994). The effect of synectics training on gifted and nongifted kindergarten students. *Journal for the Education of the Gifted, 18*(1), 55–73.	2	2	—	2	2
Robertson, S. B., & Weismer, S. E. (1999). Effects of treatment on linguistic and social skills in toddlers with delayed language development. *Journal of Speech, Language, and Hearing Research, 42*, 1234–1248.	2	1	2	2	4
Segers, E., & Verhoeven, L. (2003). Effects of vocabulary training by computer in kindergarten. *Journal of Computer Assisted Learning, 19*, 557–566.	2	2	—	2	4
Smith, C., & Fluck, M. (2000). (Re-)constructing pre-linguistic interpersonal process to promote language development in young children with deviant or delayed communication skills. *British Journal of Educational Psychology, 70*, 369–389.	2	1	—	2	4
Tyler, A. A., Lewis, K. E., Haskill, A., & Tolbert, L. C. (2003). Outcomes of different speech and language goal attack strategies. *Journal of Speech, Language, and Hearing Research, 46*(5), 1077–1094.	1	1	—	2	4
Valdez-Menchaca, M. C., & Whitehurst, G. J. (1988). The effects of incidental teaching on vocabulary acquisition by young children. *Child Development, 59*(6), 1451–1459.	1	1	2	2	4
Valian, V., & Casey, L. (2003). Young children's acquisition of *wh*-questions: The role of structured input. *Journal of Child Language, 30*(1), 117–143.	2	1	—	2	4

[a] *RCT = 1, QED = 2.*
[b] *Preschool or younger = 1, kindergarten = 2.*
[c] *Low SES = 1, not low SES = 2, mixed SES = 3.*
[d] *African American = 1, mixed or unknown = 2.*
[e] *Population density: Rural= 1, urban = 2, suburban = 3, unknown = 4.*
[f] *Vocabulary = 1, language composite = 2.*
[g] *Younger than age 3 = 1, age 3 and older = 2.*
[h] *Play = 1, not play = 2.*
[i] *Language impaired = 1, not language impaired = 2.*
[j] *Teacher = 1, parent = 2.*
[k] *Feedback = 1, no feedback = 2.*
[l] *Response = 1, no response = 2.*

Oral Language[f]	Age 0–3[g]	Play[h]	Language Status[i]	Agent[j]	Feedback[k]	Response[l]	Mean ES
2	2	2	1	—	—	1	0.41
1	2	1	—	2	2	2	0.41
1	2	2	2	—	2	1	0.28
1,2	1	—	—	—	2	2	1.08
1	2	2	—	—	1	1	0.22
2	2	1	1	—	2	2	2.17
1	2	2	1	—	—	—	0.84
1	1	1	2	—	2	1	1.00
2	2	2	—	—	1	1	0.51

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