

Appendix B.2:
Approaches to Promoting Children’s School Readiness:
A Review of Federally-Funded Research Initiatives Aimed at Improving
Young Children's Language and Literacy Skills
in Early Education and Care Settings

Linda Caswell
Yeqin He
Abt Associates Inc.

Working Paper prepared for *A Working Meeting on Recent School Readiness Research:*
Guiding the Synthesis of Early Childhood Research
Washington, DC
October 21-22, 2008

This paper is part of a series of working papers prepared for a meeting sponsored by the U.S. Department of Health and Human Services, Office of the Assistant Secretary for Planning and Evaluation (ASPE) and the Administration for Children and Families, Office of Planning, Research, and Evaluation (OPRE). Abt Associates Inc and the National Center for Children in Poverty (NCCP) were funded to convene the meeting. The views represented in this paper are those of the author(s) and do not necessarily reflect the opinions of the U.S. Department of Health and Human Services.

Introduction

An examination of research in the field of early childhood language and literacy development reveals substantial changes over the past two decades. Initially, a shift in the conceptualization of what constitutes literacy and when literacy begins resulted in a burgeoning corpus of research that examined children's literate experiences before the beginning of formal schooling. This perspective, termed emergent literacy, brought a new and vigorous focus to the developmental precursors of formal reading that originate in children's early years, thus broadening the scope of research to the years prior to formal schooling, that is, into the early childhood years.

Although research in the field of emergent literacy has been diverse both in topic and methodology, there is currently consensus about the key elements that are foundational to learning to read: oral language, phonological processing, and print awareness (Whitehurst & Lonigan, 2001). Research has provided empirical evidence of the relationships between these early skills and later reading abilities. For example, numerous research studies have demonstrated that early, well-developed oral language skills are a strong predictor of later reading abilities (e.g., ECCRN, 2005; Hart & Risley, 1995; Walker, Greenwood, Hart, & Carta, 1994; Storch & Whitehurst, 2002; Dickinson & Porsche, 2008; Spira, Bracken, & Fischel, 2005; Tabors, Roach, & Snow, 2001). Similarly, children who are sensitive to the sounds in words and are able to manipulate and use them are more likely to be successful in learning to read (Snow, Burns & Griffin, 1998; Pullen & Justice, 2003; Whitehurst & Lonigan, 2001) because these abilities are strongly related to decoding abilities. Finally, in terms of print awareness, studies have shown that a child's knowledge of the alphabet when they enter school is one of the single best predictors of later reading achievement (Snow, Burns & Griffin, 1998; Whitehurst & Lonigan, 2001). The ability to recognize and distinguish individual letters, as well as knowing the sounds of the language, together form the foundation for learning the sound-symbol association.

The importance of successfully mastering these skills for young children cannot be underestimated since limited early literacy skills tend to translate into persistent deficits. For example, Tabors, Snow, & Dickinson (2001) found stability between relative levels of reading performance in kindergarten and seventh grade, while Cunningham & Stanovich (1997) found the same stability between first grade and the end of high school. Therefore, the effect of poor language and literacy abilities in early childhood can be cumulative, such that children who are behind early on continue to fall further and further behind more skilled readers in reading as well as in other academic areas (Chall, Jacobs, & Baldwin, 1990). Furthermore, evidence indicates that it is very difficult to remedy children's language and literacy difficulties with compensatory programs (McGill-Franzen & Allington, 1991), particularly after third grade (Good, Simmons, & Smith, 1998). Of particular policy relevance is the fact that children of lower socio-economic status are at high risk for reading difficulties. These children tend to begin school with less-developed abilities in the three foundational skills of early literacy than their more economically advantaged peers. Thus, interest in effective interventions to improve children's early language and literacy skills is motivated in large part by the possibility of narrowing the school readiness gap.

One argument for focusing on providing comprehensive support for children's development of early language and literacy skills comes from economists such as Lynch (2004), who have conducted cost-benefit analyses that support the idea that the benefits of substantial investment in early interventions, in terms of increased educational attainment and income earnings outweigh the costs of these

investments. Similarly, Reynolds (2005) found that early interventions are the most cost-effective method to make positive contributions to at-risk children's development.

Another argument comes from evidence that most children are able to achieve grade-level reading levels if they receive effective early reading instruction (Clay, 1985; Iverson & Tunmer, 1993; Pinnell, 1989; Snow, Burns, & Griffin, 1998; Wasik & Slavin, 1993). If this is indeed the case, then perhaps it is deficiencies in teachers' instruction, rather than in children's cognitive abilities that explains the large number of reading difficulties in U.S. schools (Dickinson, McCabe, & Clark-Chiarelli, 2004). Although parents are children's first and foremost teachers, more and more children are spending a large portion of their waking hours with adults in early childhood settings. Recent research has lent support for the idea that teachers' instructional practices can make a difference in children's outcomes. For example, Huttenlocher, Vasilyeva, Cymerman & Levine (2002) found a positive association between teachers' use of complex syntax and preschoolers' comprehension of complex syntax. More importantly, they found that classroom input made up for the lack of home input for children from disadvantaged backgrounds.

Thus, based on the benefits of attending to children's deficits in language and literacy before formal schooling, the lack of success remedying these difficulties after school entry, and the high cost of not doing so for later academic achievement, educators and policy makers have turned their attention to the possibilities of improving children's skills early on. Because over half of 3- to 5-year-old children in the United States – 57% in 2005 – spend time in early childhood care and education programs, including day care centers, Head Start programs, preschools, nursery schools, or prekindergartens (U.S. Department of Education, 2006), there has been a focus on reaching the many children who are in these settings.

However, despite substantial investments by federal and state governments in early childhood center-based programs such as Head Start, Even Start and public pre-kindergarten, until recently, little rigorous research had been conducted on the effectiveness of various curricula used to improve children's early language and literacy skills in these programs. It was against this backdrop that the federal government, through various agencies, funded rigorous evaluations of multiple curricula that focused on language and literacy, as well as other important school readiness skills. The Preschool Curriculum Evaluation Research (PCER) and the Interagency School Readiness Consortium (ISRC) consortia are two such federal sources that have provided funding for rigorous evaluations of curricula used in early childhood programs.

This review provides a synthesis of the emerging findings from this set of major federal research initiatives. We examine the evaluations of program enhancements funded through PCER, ISRC, and the Evaluation of Child Care Subsidy Strategies, as well as evaluations of federal early childhood programs – National Evaluation of Early Reading First and Head Start Impact Study – in terms of key issues in the field of young children's language and literacy development prior to formal schooling. For the PCER interventions, both the cross-site evaluation and individual papers (when available) were reviewed. For the ISRC interventions, the evaluations of which were funded later, there is no cross-site evaluation and most study teams had only reported initial findings in the form of conference presentations rather than journal articles. Therefore, the review of the ISRC interventions should be considered preliminary as findings are still emerging from this work. After synthesizing the set of studies, some possible directions for future research are suggested based on this body of research.

Key Issues in Early Childhood Language and Literacy

Below, we synthesize the findings from the studies reviewed, which examine the effects of different early care and education interventions on teacher and child outcomes. This paper focuses solely on child outcomes. We begin by discussing the evidence that federally-funded research on early childhood language and literacy-specific curricula has provided in terms of identifying effective interventions for improving young children’s oral language, phonological sensitivity, and print knowledge skills – the three foundational skills upon which later literacy is based. We then discuss what this body of research has added to our understanding of some of the key factors that moderate the effectiveness of intervention programs. It should be noted that a challenge in reviewing this body of research was that most interventions were broad-based, encompassing many different components. This meant that, in this set of studies, when positive effects on child outcomes were found, it was often not possible to determine which of the many components was contributing to these effects. Fortunately, a more extensive review to be released soon – the National Evaluation of Early Literacy (NELP) – will be able to provide some insight into this question.

What Evidence Is Provided About Improving Children’s Skills in Oral Language, Phonological Sensitivity, and Print Knowledge?

Oral Language

As more and more young children spend large portions of their time with teachers in early education settings, the quality of teacher language use plays a critical role in driving children’s early language development. For example, studies have demonstrated that cognitively challenging conversations that address decontextualized or relatively abstract topics are particularly beneficial to children’s language development (Dickinson, 2001a, 2001b; Dickinson & Smith, 1994). Unfortunately, not all teachers can provide high quality conversations, comments or questions. This is especially true with those underpaid or poorly prepared teachers serving low-income children in publicly funded programs. A descriptive study within the PCER initiative (Massey, Pence, and Justice, 2008) confirmed these prior findings about teacher talk by examining the quality and quantity of teacher questions in 14 preschool classrooms (both treatment—Language-Focused Curriculum—and control) serving economically disadvantaged 4-year-olds. They found that questions characterized one third of all teacher utterances, with management questions (e.g., “Are we ready?”) occurring most frequently (44.8%), followed by more cognitively challenging questions (32.5%; e.g., “What do you think will happen next?”) and less cognitively challenging questions (22.7%; e.g., “What was this called?”) That is to say, more cognitively challenging questions represented only one tenth of all teacher utterances in the at-risk preschool classroom. They further examined the frequency of use for different types of questions across various classroom contexts and found that more cognitively challenging questions occurred most frequently in storybook reading. Unfortunately, according to Dickinson (2001a), only 1% to 4% of the total day is typically spent on storybook reading in early care and education settings.

The aforementioned findings naturally raise the following question: Are curricula that extend storybook reading time more effective in promoting children’s language development? Several studies within the ISRC and PCER initiatives examined the effects of curricula that include interactive reading activities in the daily plan. The Head Start REDI (Research-Based Developmentally Informed) program developed a curriculum featuring interactive reading activities

based on shared reading and dialogic reading, providing teachers with scripted books and targeted vocabulary and instructing teachers to elicit children’s language more effectively and to be more responsive. A randomized control trial was employed to compare 4-year-olds in the intervention condition and a similar group in non-intervention Head Start classrooms. The post-intervention tests showed that, after being exposed to the intervention for seven to eight months (September to March/April), children in the treatment group outperformed the comparison group on both vocabulary and language use at home (with effect sizes of .15 and .25, respectively), but no effect emerged on measures of children’s grammatical understanding. Similar results were obtained from other curricula that integrated interactive reading activities into the curriculum, such as *Children’s School Success (CSS)* and *Literacy Express (LE)*. HLM analyses demonstrated that *CSS* improved children’s vocabulary and language use at home through changing teacher practice (e.g., more sensitive-responsive talk, richer talk, better instructional support). Teacher practice accounted for 53% and 67% respectively of the intervention effect on vocabulary and language use at home. *LE* was found to have a significant impact on expressive communication skills ($ES = .30$) and a potentially positive effect¹ on vocabulary ($ES = .45$). Over all three measures used in the oral language domain, the average effect size was .36.

In addition, dialogic reading or reading-aloud was an important component of three other early childhood curricula—*Breakthrough to Literacy (BTL)*, *Ready, Set, Leap! (RSL)*, and *Building Early Language & Literacy (BELL)*. Despite sharing common purposes, these three curricula differ in activity designs and implementation. Both *BTL* and *RSL* are comprehensive language and literacy programs that include activities throughout the day. *BTL* is built around a series of weekly books with a focus on interactive reading; while *RSL* utilizes interactive electronic technology and thematically-grouped children’s trade books. In contrast, *BELL*, as an add-on pre-kindergarten literacy program, entails only two daily 15- to 20-minute lessons. The *Project Upgrade* study compared the curricula to each other and a business-as-usual control group. The results revealed that *RSL* and *BTL* had significant impacts on children’s definitional vocabulary ($ES = .30$), even though the impacts were not large enough to reduce the gap (see below). On the other hand, *BELL*, the less intensive curriculum, yielded no significant impacts on any measures of early language and literacy. Taken together, findings from these studies may suggest that curricula with a focus on interactive reading activities do exert positive impacts on children’s oral language development, given enough dosage of implementation.

Even though interactive reading seems to be an effective ingredient to improve oral language, not all curricula put an emphasis on interactive book reading. Instead, some PCER/ISCR curricula provide specific and explicit instructions to teachers to foster frequent and long high quality conversations that use complex syntax and address abstract concepts. For instance, the *Language-Focused Curriculum (LFC)*, designed for preschoolers with language limitations, identified specific linguistic targets (e.g., verb phrase structures, adjective, pronouns, etc.) in daily lesson plans and instructed teachers to use a set of *Language Stimulation Techniques (LSTs)* to foster the delivery of linguistically-responsive conversations with children. In a study with a random-control trial design, Justice, Mashburn, Pence, Wiggins (under review) analyzed children’s 10-minute language samples gathered in the fall and spring, with the amount of professional development that teachers received matched in the intervention group and comparison group. However, they found no impacts of *LCF*

¹ Potentially positive is a rating given by the What Works Clearinghouse (WWC) indicating that although the difference between the treatment and control groups was not statistically significant, the effect size was large enough to be considered substantively important according to WWC criteria (i.e., at least .25).

and *LST* exposure on children's expressive language skills. Instead, the results demonstrated that children who attended preschool more frequently benefited more from the *LCF* curriculum and *LST* exposure compared to those with low attendance (no effect size reported). This finding is not unexpected: if a child does not go to class frequently, how can s/he benefit from the curriculum? From another angle, this finding aligns with the result of the *Project Upgrade* study that showed no impact of the lower dosage curriculum, *BELL*.

Two other curricula, *Let's Begin with the Letter People* and *Doors to Discovery*, also provide teachers with a detailed plan of the scope and activities that are developmentally appropriate to enhance literacy development. This plan provides specific instructions to help teachers determine group size, sequence instructional goals, and match appropriate materials with learning objectives. Both curricula are thematically based and involve the use of learning centers in the classroom. Despite the similarity, *Let's Begin with the Letter People* has a particularly strong emphasis on letter knowledge and phonological awareness while *Doors to Discovery (DD)* puts a strong emphasis on language. In an experimental study funded under PCER, Assel and his team (Assel, Landry, Swank, & Cunnewig, 2006) examined the effectiveness of the two curricula across three different settings (Head Start, Title I, and Universal pre-K classrooms) and included a control group in each setting, in which teachers used teacher-developed, nonspecific curricula. The results revealed that both of the intervention curricula demonstrated similar effectiveness. The auditory comprehension and vocabulary skills of children in classrooms using either of these two curricula grew more than children in control classrooms, but this effect was moderated by program site (Head Start versus Title I versus Universal pre-K).² For auditory comprehension, children in Head Start showed the greatest gains compared to children in control classrooms, while for vocabulary, children in Head Start and Title I classrooms showed the greatest gains. Because their primary interest was to identify differences in the rates of growth of child skills over time, the authors acknowledge that their design did not control for differences in children's baseline scores. It was the case that universal pre-K children consistently showed higher initial scores than children in the other two programs, and Title I children outscored Head Start children. Therefore, differences in gains could be due to the fact that the Head Start children, who started with lower baseline scores, had more room to grow.

Two large national evaluations also demonstrated mixed results on children's oral language outcomes. *The National Evaluation of Early Reading First*, using a regression discontinuity (RD) design, evaluated the effect of additional funding for teacher professional development on teacher, classroom, and child outcomes. A variety of curricula were used in funded and non-funded early childhood sites, however, teachers in the funded sites received more professional development in all areas (language & literacy, assessments, and child development and behavior) than teachers in the non-funded sites. The program demonstrated positive impacts on teachers' language use and book reading practices in the funded classrooms. However, no significant impacts were found on children's oral language skills, as measured by the Expressive One-Word Picture Vocabulary Test or the Auditory Comprehension subscale of the Preschool Language Scale-IV. These findings mirror those from the recent Reading First Interim Study (Gamse, Bloom, Tepper, & Jacob, 2008), which also used an RD design to examine the effects of a federal funding stream at the K-3 level. Although the study found positive effects on teacher instructional practice, those effects did not translate into positive effects in student achievement. On the other hand, the National Head Start Impact Study

² The authors note that program site was confounded with child ethnicity (i.e., more Hispanic children in Head Start and Title I versus Universal pre-K) so that controlling for site in their design essentially controls for child ethnicity.

found small positive impacts on 3-year old children's vocabulary scores (effects sizes in the .10 to .20 range).

Results of the PCER cross-site evaluation, however, were disappointing with respect to oral language. It should be noted that the lack of effects in the PCER cross-site evaluation could be due in part to small sample sizes, to the timing of the baseline testing, which sometimes occurred later than the baseline testing done by the individual evaluations (Assel et al., 2006), or to differences in measures (Justice et al., under review). Only two of twelve curricula were found to have positive impacts on children's oral language skills in either pre-K or kindergarten: *DLM Early Childhood Express with Open Court Reading Pre-K (DLM)* and the *Early Language and Literacy Model (ELLM)*. For *ELLM*, effects were found only in kindergarten (not in pre-K), a surprising finding given that 11 of the 14 *ELLM* teachers were in their second year of implementation of the curriculum at the time of the evaluation. Effect sizes for both curricula were medium and similar in kindergarten for both curricula on the PPVT and the TOLD (Effect sizes range from .34 to .48), while in pre-K, *DLM*'s effects were in the .40 range. One similarity across these curricula is the fact that both *ELLM* and *DLM* are implemented in combination with already comprehensive early childhood curricula and provide teachers with ongoing professional development and support, possibly indicating that the amount of curricular support to teachers needs to be fairly substantial in order to obtain effects on children's outcomes.

In sum, these recent federally-funded research initiatives, although far from conclusive, have provided some confirmatory evidence that children's oral language outcomes can be improved when teachers engage in and provide children with more complex language activities and opportunities. The fact that effect sizes for oral language were medium (according to Cohen, 1988), and not small, is a hopeful finding. The positive results, however, may be moderated by numerous factors, including the instructional support for the teacher, the dosage received by the child, and the program site, which in many cases serves as a proxy for other characteristics of children and teachers in those sites, including baseline test scores, poverty status, or teacher experience. Future research should focus on identifying more concretely the factors that need to be put in place to obtain consistent oral language gains, as well as the size of the effect that is needed to ensure success in reading comprehension.

Phonological Sensitivity

As stated above, the ability to distinguish and manipulate sounds is a strong predictor of reading success. Phonological awareness has been well documented for its critical role in learning to read (e.g., Gunning, 2000; Juel, 1994; Shu, Anderson, & Wu, 2000; Snow, Burns, & Griffin, 1998). Children who are more aware of the different sounds in words and are able to separate or combine sounds are more ready to learn to read and write. Studies have found that explicit instruction in phonological awareness can reduce the incidence of reading failure and thus improve the possibility of reading success (Adams, 1995; Stanovich, 1993; Snow et al., 1998).

In general, less evidence was found that the interventions studied through recent federally-funded research initiatives exerted positive impacts on children's phonological awareness skills than was found in terms of oral language. Neither of the two national evaluations included in this review, of Early Reading First and of Head Start, found effects on children's phonological awareness skills. Similarly, in the PCER cross-site study, 11 of 12 interventions showed no statistically significant effects in this domain (but note that possible limitations for the PCER cross-site evaluation listed above for the oral language domain apply for the phonological awareness domain as well). Only one

intervention – *DLM* – was found to have positive effects in pre-K and kindergarten as measured by the Pre-CTOPPP (pre-K) or the CTOPP (kindergarten) with effect sizes ranging from .32 to .38.

In contrast to the PCER cross-site evaluation findings, however, the individual evaluations of several curricula indicated some positive effects on children’s phonological awareness skills. As mentioned above, differences in findings between the cross-site evaluation and the individual evaluations could be due in part to small sample sizes, differences in the timing of baseline testing, or to differences in measures. For example, *Literacy Express* was found to have an average positive effect size of .63 in the phonological processing domain, as measured by the P-CTOPPP Blending and Elision subtests at the end of pre-K (Lonigan, 2006). Similarly, the *Project Upgrade* study demonstrated that *Ready, Set, Leap! (RSL)* had a significant impact on children’s phonological awareness skills at the end of pre-K as measured by the TOPEL (ES = .39, when compared to the control group jointly with another intervention, *Breakthrough to Literacy*). In a study of *Let’s Begin with the Letter People* and *Doors to Discovery* (Assel et al., 2006), children in classrooms receiving either curriculum showed greater gains in rhyming skill than those in control classrooms, as measured by the Woodcock-Johnson-3 Sound Awareness subtest ($d = .26$). Additionally, there were differences in rates of growth by curricula that were moderated by program site, such that universal pre-K classrooms using *Let’s Begin* had higher rates of growth than those using *DD* by an effect size margin of .85. No differences, however, were found in children’s rates of growth between the two curricula in Head Start and Title I classrooms (Assel et al., 2006). The same caveats mentioned above apply to these findings, that is, since Head Start and Title I children began with lower baseline scores than those in Universal pre-K, they may have been more likely to gain at a faster rate .

Some preliminary findings from the ISRC consortium are in line with the aforementioned findings. For example, in the Head Start REDI study, significant impacts on phonological awareness were found (ES = .39 for Blending subtest of the TOPEL, .35 for Elision subtest). This curriculum provided professional development for teachers that focused on implementing sound games (three times per week). The evaluation of *Children’s School Success* found an interaction effect between pretest scores and quality of implementation on children’s early literacy outcomes, including phonological awareness. The study found that children who scored lower on pretest measures benefited more from high implementation and less from low implementation of the curriculum.

In sum, recent federally-funded research initiatives have provided mixed evidence of the studied curricula’s effectiveness to improve children’s phonological sensitivity skills. This lack of consensus could be due to methodological issues such as statistical power or differences in measurement of these skills. Or, it also could be the case that gains in this area are difficult to effect. Future research needs to address these methodological issues so as to produce more conclusive results. In addition, as with oral language, moderating factors – such as dosage, children’s pre-test scores, and program site – are cited in these studies. Planned variation studies would be an important addition to further clarify the role of these moderators of intervention effectiveness.

Print Knowledge

In line with the core research about the essential role of print and letter knowledge for later literacy success (e.g., Clarke, 1988; Clay, 1991; Torgeson & Davis, 1996; Whitehurst & Lonigan, 2001), the majority of the interventions reviewed targeted children’s print knowledge as an essential skill. The goal of these interventions was to improve children’s print and letter knowledge skills through training teachers how to a) explicitly teach these skills, and/or b) provide children with opportunities

to practice these skills. Was there evidence that the interventions were effective in improving children's print and letter knowledge? Although not entirely consistent, the majority of interventions that targeted this area showed some evidence of positive effects. The national evaluations of ERF (U.S. Department of Education, 2007) and Head Start (U.S. Department of Health & Human Services, 2005) both had positive impacts on children's print knowledge. Head Start reduced, by almost half (47%) the gap in children's ability to recognize letters between Head Start children and the national average for all 3- and 4-year olds. Similarly, the impact of ERF on children's print and letter knowledge was 5.78 standard score points on the Pre-CTOPPP print awareness subtest (ES = .34).

The PCER cross-site evaluation conducted by Preschool Curriculum Evaluation Research Consortium (2008) indicated positive impacts for only two curricula of eleven that focused on children's language and literacy development – *Curiosity Corner (CC)* and *DLM*. The former curricula had an impact in kindergarten, while the latter had impacts in both pre-K and kindergarten. Of the three measures used, *CC* demonstrated positive impacts on the TERA and the WJ Letter Word Identification subtest (ES = .43 for both), while *DLM* had positive impacts on all three measures in pre-K (the TERA, the WJ Letter Word Identification subtest and the Spelling subtest) equaling effect sizes of .68, .51, and .46 respectively. In kindergarten, *DLM* had impacts only on the TERA and the WJ Letter Word Identification subtest (effect sizes equaled .76 and .50 respectively).

Of the nine remaining curricula that did not demonstrate statistically significant impacts in this domain in the cross-site evaluation, five were studied in individual evaluations and were found to have positive effects (*ELLM*, *Let's Begin*, *DD*, *Literacy Express*, and *Ready, Set, Leap!*). For example, the individual evaluation of *ELLM* suggests that the curriculum, which focuses on instructional strategies and learning materials for teachers to explicitly teach literacy skills and provide structured literacy experiences, had small, positive effects on measures of letter knowledge, print conventions, and meaning of print at the end of prekindergarten in favor of the intervention (effect sizes equaled .25, .28, and .26 respectively). By the end of kindergarten, positive effects were found only on letter knowledge (ES = .34). Similarly, *Let's Begin with the Letter People* and *Doors to Discovery* were both found to have positive effects on Head Start children's print knowledge skills, compared to children in Title I or Universal pre-K classrooms (ES = .53 for HS, versus .06 for Title I and .25 for Universal pre-K). The measure used in the study was the WJ-3 Letter Word Identification subtest. In the case of *Literacy Express*, the curriculum demonstrated statistically significant positive effects on children's skills in this domain, as measured by several assessments – the TERA-3 Alphabet subtest, the TERA-3 Meaning subtest, and the WJ-3 Spelling subtest (effect sizes equaled .57, .83 and .50 respectively). On two other measure – the P-CTOPPP Print Knowledge subtest and the TERA-3 Print Conventions subtest, impacts were not statistically significant, but were large enough by WWC standards to be substantively meaningful (effect sizes equaled .41 and .34 respectively). Finally, in the *Project Upgrade* study (U.S. Department of Health and Human Services, 2007), *RSL*, along with *BTL* had significant impacts on children's print knowledge skills, as measured by the Print Knowledge subtest of the TOPEL (ES = .63).

In summary, the majority of curricula evaluated seem to have been able to exert positive effects in the area of print knowledge across varied assessments and conditions, however there is much more to be done. The more extensive NELP review should provide more insight into common features across interventions that show effects on children's print knowledge. Future research would also benefit from moving beyond establishing the link, as done in the ERF evaluation, that more time spent by teachers on print awareness opportunities is related to children's higher print awareness scores, to

identifying more effective ways to teach children alphabetic knowledge. For example, in one non-experimental descriptive study funded by PCER (Justice, Pence, Bowles & Wiggins, 2006), findings based on children in classrooms using either the *Language-Focused Curriculum* or *High/Scope* indicated that the order of letter learning was not random and that some letters hold an advantage over others to influence their order of learning. The authors suggest that perhaps early care and education teachers should teach more difficult, less known letters first, since children are more likely to know more common letters. Teachers should also account for individual differences since children know different letters, depending on both extrinsic and intrinsic influences.

What Evidence Is Provided About Factors that Moderate Intervention Effectiveness?

A review of some of the interventions evaluated for this review points to the range of activities/components that are often implemented with the goal of producing positive changes in children's early language and literacy outcomes. For example, *ELLM* includes five components: research- and standards-based literacy curriculum, family involvement, professional development, working partners, and practice-focused research and evaluation. The interrelationships among these components and their interdependence were prominent, and were discussed in almost every study that was reviewed for this paper. When these comprehensive curricular approaches are implemented in early childhood settings, which are dynamic and complex learning environments in themselves, it becomes difficult to tease out the critical features for success from the wide range of possible influences. Yet, it is important to understand what factors might be moderating the effectiveness of interventions. Because variation in these factors was not a focus of this body of research – the aim of which was to provide evidence of effectiveness of the interventions studied, *on average* – researchers were not always able to address questions about moderating factors. In addition, most analyses of moderators were conducted outside an otherwise experimental design, and as such, cannot be considered causal. Despite these limitations, in the research reviewed in this paper, some, mostly non-experimental evidence was provided regarding three possible critical factors that the studies suggest may be important moderators of intervention effectiveness: professional development, dosage of implementation, and child background characteristics.

Professional Development/Coaching

Before implementing the specific curriculum, teachers (and sometimes other educational staff) usually received professional development or training on how to deliver the intervention. Some interventions also provided ongoing coaching to monitor or refresh ideas and to solve problems arising during ongoing implementation. Professional development may affect the impact of an intervention through changing teachers' practice and fidelity. Using non-experimental methods, the *LFC* study showed that treatment teachers exhibited strikingly high fidelity to the curriculum immediately following a professional development workshop (Pence, Justice, & Wiggins, in press). This aligns with the findings of an evaluation of *Building Language and Literacy* in Montgomery County public schools (Ramey, Ramey, Kleinman, Lee, Farneti, Timraz, Nielsen, et al., 2008 unpublished manuscript), which compared two coaching conditions: weekly versus monthly. It revealed that weekly work-embedded coaching significantly improved implementation levels of the curriculum and yielded significant positive impact on children's literacy skills ($ES = .44$). These contrasts were tested within the experimental design and indicate that sufficient professional development may be related to the success of an intervention.

Professional development can even compensate for the insufficiency in teachers' educational background. The *Project Upgrade* study (U.S. Department of Health and Human Services, 2007) analyzed (outside of the experimental design) the observational data from study classrooms, and, surprisingly, instead of finding an educational background effect, the results demonstrated that the interventions eliminated the differences between better-educated teachers and less-educated teachers. Teachers in the treatment group all looked remarkably similar, regardless of their educational levels, compared with the dramatic differences among control group teachers. In other words, the professional development that treatment group teachers received and the well-specified curricula diminished the differences in teaching instruction due to teacher educational background. Similarly, another group of researchers (Lieber, Goodman-Jansen, Horn, Palmer, Hanson, Czaja, Butera, et al., 2007) examined 30 Head Start teachers in implementing the *CSS* curriculum and found that coaching and teachers' motivation to change, rather than teaching experience or degree status, affected curriculum implementation. These analyses were correlational, and outside of the experimental framework.

Dosage of Implementation

Program dosage can be measured in days of children's attendance during the academic year. When measured in this way, greater program dosage has been found to be related to stronger program impact. For example, in a study of two state public pre-K programs, Ramey, Ramey, and Stokes (year not provided) found that children who received the full day and full school year *LA4* program (Louisiana) gained nearly twice as much from the program as their peers who received only the half-year *LA4* program (pilot year) or the half-day full year Montgomery County Public Schools program (Maryland). Similarly, in an experimental study of *LFC*, researchers found that children who attended early care and education regularly benefited more from the intervention than those with low attendance rates (Justice, Mashburn, Pence, Wiggins, under review). It can be inferred that children who attended school more regularly were exposed to a higher dosage of the intervention compared to those who attended school less regularly.

Program dosage can also be thought of in terms of the amount of time that has been allotted for the curriculum to be implemented. In the *Project Upgrade* study (U.S. Department of Health and Human Services, 2007), the three curricula being compared—*RSL*, *BELL*, and *BTL*—all focused on the development of early literacy skills and knowledge. However, they were distinguished from one another in terms of instructional approach, materials provided, intensity and cost. Both *RSL* and *BTL* are full-day comprehensive curricula; *BELL* is an add-on literacy program entailing only two 15-20 min sessions daily. The finding that both *RSL* and *BTL* had significant impacts on all literacy measures compared to the lack of impacts of *BELL* suggests that dosage of the intervention should account for part of the differences in impacts on children's outcomes. This is more persuasive considering that *BELL* had a much stronger focus on phonological awareness than the other two curricula, yet had no impact on children's phonological awareness while *RSL* and *BTL* did.

Child Background Characteristics

Findings of some studies also revealed that child background characteristics (such as family economic status, pretest performance, personality, and language ability) may moderate the impacts of interventions. The research demonstrated that the interventions were effective for all children, but were particularly effective for *some* children. For example, children who were more economically or academically disadvantaged were found to have gained more from interventions than their more advantaged peers (Assel et al, 2006; Ramey, Ramey, & Stokes, 2008 unpublished manuscript; Odom,

Diamond, Hanson, et al., 2007). In a study that examined the contributions of child characteristics to the quality of teacher-child relationship, Rudasill, Rimm-Kaufman, Justice and Pence (2006), in their study of *LFC*, demonstrated that individual differences in child temperament and language skills affected teacher-child interactions, which ultimately contributed to intervention effect. This was especially true for early language and literacy curricula, in which teacher-child conversations are often key cornerstones of the implementation.

English Language Learner (ELL) status is also a very important factor when considering children's early language and literacy skills. Although most studies included ELLs in their study samples, results were not often reported by subgroup. This was perhaps due to power issues, since most studies were not powered to detect subgroup differences. An exception is the *LA ExCELS* (Los Angeles: Exploring Children's Early Learning Settings) study which explored ELL children's experience in early care and education settings and their school readiness outcomes (Fuligni, 2008). Preliminary results showed that low income bilingual Spanish children were behind monolingual peers in several language and school readiness domains during pre-kindergarten period. There were no differences in experiences of Spanish speaking and English monolingual children in early care and education programs at age 4. However, participation in early learning settings was particularly beneficial for Spanish speaking children. This is consistent with the aforementioned pattern that academically disadvantaged children benefited more from interventions or programs compared to their advantaged peers.

Child background in terms of family factors also includes family literacy environment and parent behavior. These issues were addressed by the *Getting Ready Nebraska* program. In this program, several studies examined the effects of home literacy and parents' belief or behavior on children's development. In a study investigating adolescent parents' participation in learning and their perceptions of professional support, Knoche, Woods, & Sheridan (2008) found that for children whose parents demonstrated low levels of parent learning behaviors, high levels of professional support were associated with higher scores in young children's language skills.

In sum, the federally-funded evaluation studies reviewed here provide support and replicate previous findings about factors that may be important as moderators of intervention effectiveness. However, many questions remain. For example, how much professional development is optimal? What amount of dosage of intervention is needed for children to progress? What interventions work best for which children? One way to address this in the future would be to conduct planned variation studies, in which hypotheses about "how much" and "for whom" can be tested. From this data, threshold levels for professional development and dosage, for example, could be more clearly understood and ultimately be used to inform intervention developers and policy makers.

Directions for Future Research

In addition to the specific suggestions for future research at the end of each section above, there are several comments regarding future research that apply in general based on the review of this corpus of research. From a substantive point of view, more focused attention should be paid to the needs of some subgroups of children, especially ELLs. As aforementioned, although most studies did a commendable job of including a diverse population of children in their studies, impacts on subgroups were seldom examined. In part, this may be an issue of research design, since effectiveness studies are designed to provide an overall mean, and are often not powered to be able to detect subgroup

differences. However, future research should certainly focus on the specific needs of these children, who make up more and more of the population of children in early care and education settings.

Another substantive issue that should be addressed in future research is trying to determine the active ingredients in those interventions for which positive effects were found. Because most of the PCER interventions, for example, incorporated multiple components, when effects were found, it was not possible to identify which component had led to the positive effect. More fine-tuned research would be able to disentangle the effects of various components and move the field forward in terms of identifying the most critical ingredients of interventions. In addition, the NELP, a much more extensive review, should be able to provide further insights into this question.

From a methodological perspective, it was quite remarkable that there were more than a dozen randomized controlled trial (RCT) studies of early childhood interventions to review. On the one hand, the national push for more rigorous research in the field has certainly increased the number of RCTs that have been implemented and, in this way, has improved the rigor of the research available. On the other hand, effectiveness research studies utilizing RCT designs have their own set of limitations. For example, in terms of statistical power, it is clear that in order to detect the types of effects on children that we would expect across one school year, sample sizes must be fairly large. Although RCTs require fewer units of randomization than say, regression discontinuity designs, it is still the case that in order to detect small effects, sample sizes must typically be in the range of 60 units with nested designs (observations within children within teachers, for example). Since randomization often occurs at the center level to avoid contamination across teachers within the same center, this can be quite a challenge for most researchers. One way to decrease sample size requirements is to conduct random assignment at the child level. This alternative, however, is not always practically or pragmatically feasible.

In addition, there is a trade-off between internal and external validity. Although the strength of RCTs is their high internal validity, they can suffer from low external validity. Especially in early care and education settings, when researchers are often limited to creating their study samples based on those who agree to participate from their overall recruitment efforts, generalizability can still be quite limited and therefore less policy relevant.

Meaningful detectable effect is another methodological issue that arises after reading these studies. In general, effect sizes were reported in terms of Cohen's d , and Cohen's guidelines for what is considered small (.20), medium (.50), and large (.80) are used. However, unless the author reports what the range of the assessment is and what the expected growth across a school year is, it is difficult to make a judgment about the substantive meaning of a .20 versus a .50 versus a .80 effect size. What does this mean in real world terms? What is a meaningful effect size? How does that vary by assessment or domain? Without diminishing the advances made in the field in the reporting of effect sizes, it would be helpful to also report a translation of Cohen's d into assessment-relevant terms, such as months of growth.

Finally, the PCER and ISRC initiatives have certainly made huge strides in terms of providing examples of conducting evaluations of programs and practices in real world settings. Lessons learned from these initiatives will make an important contribution to the field, both substantive and methodological. Lessons learned could address the wealth of knowledge of the implementers after having done these studies; suggest possible hypotheses for effects, or lack of effects, on child outcomes; and provide direction for future rigorous studies, of which there are certain to be more.

From a policy perspective, the issue of cost was not addressed in any of the studies that were reviewed. In line with the suggestion above regarding cost-benefit analysis in terms of achieving positive child outcomes, research on the cost of implementing the interventions would be useful for policy makers and educators.

Summary

This preliminary review of the published and unpublished papers on these federally-funded intervention evaluations suggests that there is evidence for positive effects of some of the selected interventions on some of the important early childhood language and literacy outcomes. However, evidence from these studies is not sufficient to inform policy makers about ways in which to assemble the critical ingredients necessary for more widespread and consistent success in raising young children's literacy outcomes. Many inter-related factors influence the effectiveness of interventions, some of which are just beginning to be understood. In addition, the experimental studies supported by these federal initiatives have proven that it is possible to conduct rigorous studies in early childhood settings and have moved the field forward in terms of methodology. Ongoing improvements and attention to new issues arising from these more rigorous methodologies will, however, be necessary. Both in terms of substance and methodology, therefore, the studies examined here constitute an important contribution to the knowledge base that informs early language and literacy education. Research on the characteristics of high quality programs that are both developmentally appropriate and successful in bridging the achievement gap will be in demand from legislators and policy makers as they are called upon to make informed decisions about early learning systems.

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