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PRE-LITERACY INTERVENTIONS FOR
PRESCHOOL STUDENTS

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Structured Abstract

Clinical Question: What helps preschool students acquire pre-literacy skills?

Method: Scenario Review

Source: Meta-analyses of early literacy in preschool children

Search Terms: preschool AND literacy AND meta-analysis

Primary Results

1. Code-focused interventions had the largest impact on phonological awareness skills (PA), alphabet knowledge (AK), reading, and spelling.
2. Phonemic awareness and phonics training showed positive effects on PA, AK, oral language, reading, and spelling.
3. Shared book reading showed positive effects for preschool and at risk students.

Conclusions

Shared book reading, and code-focused interventions that combine PA and phonics are the most promising interventions, based on the available evidence.

Pre-Literacy Interventions for Preschool Students

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Scenario

Janice, a preschool teacher, is concerned about Samuel who is a new student in her class. Samuel is 5 years old and will enter kindergarten next fall. When he started preschool, his parents told Janice that he did not have any developmental difficulties or any difficulty expressing himself. They did not express any concerns about his development in general. Soon after Samuel came to her class, Janice noticed that he typically sat quietly during story time without responding to her questions or interacting verbally with her and often did not initiate social interaction with other children in the class.

In the two months since Samuel joined Janice's class, she has observed him carefully and has some concerns about his language skills. Janice is also concerned about the development of Samuel's pre-literacy skills because he does not show much interest in the classroom books and she is unsure how much experience he has had reading books or participating in other pre-literacy activities. Janice contacted Maria, the school speech-language pathologist (SLP), and asked for her help in determining how best to help Samuel develop his oral language skills, as well as his pre-literacy skills. Maria observed Samuel during circle and story time. She noted that Samuel appears to have a limited vocabulary and difficulty demonstrating knowledge of pre-literacy concepts, such as phonological awareness and print concepts.

When Janice and Maria met to discuss their observations, they agreed that Samuel exhibits difficulty with spoken and written language. Although Maria feels confident offering Janice guidance about how to help Samuel develop his spoken language skills, she does not feel as confident in recommending interventions or instructional practices to help Samuel develop pre-literacy skills. Because federal laws such as No Child Left Behind [NCLB] and the Individuals with Disabilities Educational Act [IDEA] mandate the use of scientifically-based instruction and interventions, Maria and Janice decided to

look for resources that would help them better understand what types of evidence-based interventions are available to increase pre-literacy skills for preschool students.

Background

The term *emergent literacy* is used to refer to the knowledge, skills, and attitudes young children have about literacy that develop before conventional reading and writing skills (Teale & Sulzby, 1986; Whitehurst & Lonigan, 1998). Since the conception of the term, many researchers have proposed various components of early literacy that are linked with later literacy outcomes. For example, Whitehurst and Lonigan (1998) suggested that the components of early literacy can be broken into two components—*outside-in* and *inside-out skills*. Outside-in skills are sources of information from outside the printed word that directly support understanding of the meaning of printed words and include language skills, narrative skills, conventions of print and emergent reading. In contrast, inside-out skills are the sources of information from the printed word itself and include knowledge of graphemes, phonological awareness, syntactic awareness, phoneme-grapheme correspondence, emergent writing, phonological memory, rapid naming, and print motivation. Lonigan (2006) subsequently concluded in a narrative summary of existing research that oral language, phonological processing skills, and print knowledge were the strongest predictors of reading outcomes.

More recently, the National Early Literacy Panel (NELP, 2008) completed a systematic review and meta-analysis to identify the skills that strongly predicted later conventional literacy skills and assess the effectiveness of early literacy interventions. The results of their study found that alphabet knowledge, phonological awareness, rapid naming tasks, writing or writing name, and phonological short term memory were consistent predictors that possessed moderate relationships with later literacy outcomes.

Two other recent meta-analyses have been conducted that provide findings related to evidence-based interventions that increase pre-literacy skills in preschool children. First, Mol, Bus, and de Jong (2009) completed a systematic review and meta-analysis to examine the effects of interactive book reading on oral language and print knowledge. Their review only included interactive, shared book reading interventions with children in preschool through first grade. The overall results from the analyses showed that interactive book reading had statistically significant positive effects on oral language ($d = 0.54$, $CI = 0.33/0.74$), expressive vocabulary ($d = 0.62$, $CI = 0.29/0.95$), receptive vocabulary ($d = 0.45$, $CI = 0.22/0.68$), alphabet knowledge ($d = 0.39$, $CI = 0.16/0.62$), phonological sensitivity ($d = 0.43$, $CI = 0.25/0.62$), and orthographic awareness ($d = 0.41$, $CI = 0.20/0.62$). When comparing the results of preschool students to those of older kindergarten children, no statistically significant age differences were found for oral language, phonological sensitivity, expressive vocabulary, or receptive vocabulary. However, a statistically significant effect for alphabetic knowledge was found for older kindergarten children ($d = 0.53$, $CI = 0.34/0.72$), but not for preschool students ($d = -0.03$, $CI = -0.35/0.29$). Thus, these results indicate that interactive shared storybook reading is an effective intervention to increase oral language, receptive vocabulary, expressive vocabulary, and phonological sensitivity, which are similar to the NELP findings that showed shared storybook reading as an effective intervention to increase oral language and print knowledge skills.

In 2010, Piasta and Wagner conducted a systematic review and meta-analysis to examine the effect of interventions designed to increase alphabet knowledge. Their review extended the findings of the NELP report in four ways. Their review

- included studies published through November 2006;
- separated alphabet knowledge into five discrete outcomes (letter name knowledge, letter sound knowledge, letter name fluency, letter sound fluency, and letter writing);
- differentiated between letter names and letter sound interventions; and
- differentiated between interventions that were multi-componential and those that focused on a single skill (such as letter name knowledge).

They also included students in preschool through third grade. For preschool and early kindergarten students, they found positive effects for letter name knowledge ($d = 0.37$), letter sound knowledge ($d = 0.65$), letter writing ($d = 0.60$), and letter name fluency ($d = 0.09$). Finally, they found that instruction that was longer in duration and provided in small-groups was more effective than short-term interventions or interventions delivered in to whole classrooms. Although these two reviews examined more focused research questions and included preschool children as well as students in older grades, the results from these two systematic reviews generally provide supporting evidence for the findings of the NELP and the effectiveness of early literacy intervention.

Method

Searching for and Retrieving the Evidence

The search for and retrieval of the evidence was guided by the principles articulated by The American Speech-Language Hearing Association's (ASHA) National Center for Evidence-Based Practice in Communication Disorders (NCEP, 2008). NCEP proposed a six-tier hierarchy of research evidence that clinicians can use to inform their search for research that would apply to clinical decisions, including: 1) well designed meta-analyses, 2) well designed randomized controlled studies, 3) well designed controlled studies without randomization, 4) well designed quasi-experimental studies, 5) well designed correlational and case studies, and 6) expert opinions. Although each of the six types of evidence can play an important role in the development of a professional's knowledge about the effectiveness of an intervention, the lower the quality of the evidence, the less credible the evidence may be when making clinical decisions. This six-tiered hierarchy places a "well-designed meta-analysis of >1 randomized controlled trial" (www.asha.org/members/ebp/assessing) as the highest quality of evidence. Thus, a first step in any attempt to identify relevant information should include a search for an already completed meta-analysis (or systematic review).

With this in mind, the search for studies that might address the issue of preschool literacy interventions began with a search for already completed meta-analyses. Three major databases were searched: ERIC, PsycInfo, and Academic Search Premier. To identify potentially useful studies from these databases, the search terms *preschool*, *literacy*, and *meta-analysis* were used as descriptive terms. No restrictions on the date, type, or language of publication were used.

Results

The results of the search yielded 15 citations: ERIC = 11, PsycInfo = 3, Academic Search Premier = 1. A review of the citation abstracts revealed that eight were not meta-analyses but were primary studies, narrative reviews or summaries of other studies/reviews of preschool literacy. Of the remaining seven studies, only one study (NELP, 2008) presented separate data for preschool age children that addressed the effects of intervention for preschool literacy development (see Table 1).

Table 1. Summary of Meta-Analyses Retrieved for Evaluation

Author	Publication Date	Dates of Included Studies	n of Included Studies	n of Children	Age Groups	Intervention(s) Analyzed	Outcomes Measured
Bus, et al.	1995	Up to 1993	33	3410	Preschool	joint book reading	Language Skills; Emergent Literacy; Reading Achievement
National Early Literacy Panel (NELP)	2008	Up to 2003	299	384–1377**	Preschool	teaching letters & words; reading and sharing books; parent and home programs; preschool and kindergarten programs; language enhancement	Alphabet Knowledge; language; concepts about print; environmental print; invented spelling; listening comprehension; name writing; phonemic awareness; phonologic short term memory; random access naming; verbal IQ; visual memory; visual perception
Mol, et al	2009	Up to Dec 2007	31	2025	Preschool & Kindergarten	interactive book reading	Oral Language Print Knowledge
Zucker	2009	Jan 1997 to Jan 2007	27*	401	Pre-K through Grade 5	electronic books	Comprehension Decoding
Bowers, et al.	2010	Up to Dec 2009	22	2652	Preschool to Grade 8	morphological	Morphological NonMorphological Lexical Nonlexical
Piasta & Wagner	2010	Up to 2006	63	8468	Preschool to Grades 3	letter naming letter sound	Alphabet Learning
Roskos	2010	1979–2009	16	1812	Preschool through Grade 2	Pretend Play Early Literacy	Oral Language Comprehension Print Knowledge

*Only 7 studies were meta-analyzed and data reported.

**The total number of participants was only reported for the outcome categories assessed. This is the range of the *n* of participants for each of the outcome categories

Assessing the Evidence

The results of a meta-analysis reflect the magnitude of the effect of an intervention and the percentage of individuals who may benefit from the intervention. The two primary statistics in meta-analysis are the effect size and the confidence interval. The effect size is the magnitude of the effect caused by the treatment or intervention. The larger the effect size, the more effective an intervention is said to be; the smaller the effect size, the less effective the intervention. Cohen's d (1988) typically is used to measure the intervention effect size and quantify small (0.2), medium (0.5) and large (0.8) effect sizes. These effect sizes are measured in standard deviation units. An effect size of $d = 0.33$ would mean that the intervention produced, on average, a gain of one-third of a standard deviation in the post-test scores of individuals in an intervention group over the individuals in a control group. To determine if the effect size is statistically significant, the confidence interval of the effect size is used. A 95% confidence interval tells us the potential range of effect sizes that could be expected 95% of the time. For example, if the meta-analysis reported an effect size of 0.91 and a confidence interval of (0.68, 1.15), this would mean that the average observed improvement of the treated group was 0.91 standard deviations and 95% of the time we can be confident that the true effect size is between 0.68 and 1.15 standard deviations. If we want to know how many children would benefit from this intervention based on the average intervention effect ($d = 0.91$), we can use a standard normal distribution table found in most statistics textbooks. Here it was found that, on average, 82% of the children in the intervention would show a positive effect of 0.91 standard deviations when compared to children who did not receive the intervention.

Now consider the following: a meta-analysis reports that the effect size of a particular intervention is $d = 0.48$ and the 95% confidence interval = -0.47 to 1.43 . This is a very different situation because the confidence interval includes the value of zero, as well as a negative value. The presence of zero or a negative value in the confidence interval indicates the possibility that the control group could actually outperform the intervention group. In other words, the true effect size could favor the participants who did NOT receive the intervention. In this case, we would be forced to conclude that any differences between the intervention and control groups were not statistically significant and could've been due to chance.

Main Results of National Early Literacy Panel Report (2008)

In the literature search, the study with data that directly addressed the purpose of this Brief and the question posed in the opening scenario was the NELP report (2008). The NELP report posed four research questions. Of particular relevance is research question two, "...which programs, interventions, and other instructional approaches or procedures have been contributed to or inhibited gains in children's skills and abilities that are linked to later outcomes in reading, writing, or spelling?" (p. 2).

The NELP obtained the data for the meta-analysis it conducted through two waves of searching the ERIC and PsycInfo databases. For research question 2, the searches resulted in 403 studies from ERIC and 571 studies from PsycInfo from 2000–2003, of which 136 studies met the criteria for inclusion in the NELP report. The studies were coded for the following variables:

1. Demographic information for each group in the study (e.g., age, gender, SES); research design (e.g., type of design)
2. Intervention characteristics (e.g., if an intervention study, length of intervention, intervention focus)

The data needed to calculate an effect size was extracted from the results section of each article.

Code-Focused Interventions

The NELP identified 83 studies that examined the effectiveness of various interventions designed to teach children code-related skills, including: phonological awareness (PA), alphabet knowledge (AK), alphabetic principle (knowledge that the letters in written words represent the sounds in spoken words), and early decoding skills (phonics). The effects of these interventions across all outcome variables are shown in Table 2.

The NELP found that code-focused interventions had the largest impact on PA skills, reading, and writing. Of particular interest to the scenario question are the results from the studies that provided results for preschool aged children. The intervention effects on the specific outcome variables indicated that code-focused interventions had a significant impact on PA, AK, reading, and spelling performance. Table 3 provides a summary of the effect size and confidence interval for each outcome measured.

Table 2. Effects of Code-Focused Interventions Across all Outcomes

Outcome	n of Studies	Effect Size	95% CI	
			Low	High
AK	24	0.38	0.18	0.58
Cognitive Ability	2	-0.41	-0.78	-0.01
Memory	9	0.27	0.06	0.48
Oral Language	14	0.32	0.09	0.56
PA	51	0.82	0.68	0.96
Print Knowledge	5	0.47	0.18	0.76
RAN*	8	0.38	0.08	0.69
Reading Readiness	3	0.20	0.02	0.38
Reading	36	0.44	0.27	0.60
Spelling	15	0.61	0.43	0.80
Writing	5	0.61	0.18	1.04

*RAN = rapid automatic naming

Table 3. Effects of Code Focused Interventions for Preschool Students

Outcome	n of Studies	Effect Size	95% CI	
			Low	High
PA	10	0.87	0.52	1.22
AK	5	0.67	0.26	1.07
Oral Language	3	0.26	-0.23	0.74
Reading	4	0.75	0.26	1.24
Spelling	2	0.78	0.29	1.27

Finally, the effects of code-focused interventions were classified into four categories: “1) interventions that included PA instruction only; 2) interventions that included both PA and AK instruction; 3) interventions that included AK instruction only; and 4) interventions that included both PA instruction and phonics instruction” (p. 112). In examining the impact of interventions classified in this way, only PA and phonics training showed positive effects on PA, AK, oral language, reading, and spelling outcomes as shown in Table 4.

Shared-Reading Interventions

The NELP (2008) also identified 19 studies that examined the effects of interventions that solely or primarily utilized shared book reading as the intervention, and defined shared book reading as, “those [interventions] that involved parents, teachers, or the combination of parents and teachers implementing some form of shared reading with children individually or in groups” (p. 153). As shown in Table 5, of the six measured outcomes only oral language, print knowledge, and spelling produced significant treatment effects.

Table 4. Effects of PA and Phonics Training on Outcome Measures

Outcome	n of Studies	Effect Size	95% CI	
			Low	High
PA	19	0.74	0.49	0.99
AK	9	0.57	0.34	0.81
Oral Language	4	0.68	0.34	1.02
Reading	17	0.66	0.41	0.92
Spelling	8	0.59	0.34	0.83

Table 5. Effects of Shared Book Reading on Outcome Measures

Outcome	n of Studies	Effect Size	95% CI	
			Low	High
AK	2	-0.06	-0.47	0.35
Cognitive Ability	1	0.10	-0.21	0.41
Oral Language	16	0.73	0.27	1.20
PA	2	0.11	-0.15	0.35
Print Knowledge	4	0.50	0.28	0.73
Readiness	1	-0.14	-0.64	0.36
Spelling	1	0.52	0.23	0.81

Additional analyses relevant to the data in Table 5 revealed that shared book reading is effective for both preschool students ($d = 0.75$) and at-risk students ($d = 0.47$). Although the results for the participants classified as not at risk were larger ($d = 0.82$) than for the participants classified as at-risk ($d = 0.47$), the NELP (2008) did not find a statistical difference between the intervention effects for the two groups.

Also of interest to the panel was the effect of shared storybook reading on vocabulary development. A total of nine studies were included in this analysis that resulted in a positive effect ($d = 0.60$, 95% CI = 0.16 to 1.05) on vocabulary acquisition for preschool children.

Finally, the NELP (2008) report analyzed the data based on whether the agent of the intervention had an effect on oral language outcomes. Table 6 presents the intervention agents identified across the 19 studies of the NELP report.

These findings suggest that teachers can effectively deliver shared storybook readings, though the parent and teacher combined did not result in a significant improvement in oral language performance.

In addition to these findings, the NELP panel reported moderate correlations between the pre-literacy skills of alphabet knowledge, phonological awareness, rapid naming tasks, writing or writing name, and phonological short term memory that were consistent predictors of later literacy outcomes of reading comprehension, decoding, and spelling. The results of these correlations are summarized in Table 7. In addition to these data, the NELP panel also indicated that the results of individual studies reporting multivariate statistical analyses provided additional evidence supporting the importance of these specific pre-literacy skills as predictors of later reading and writing skills.

Table 6. Effect Sizes for Intervention Agent on Oral Language

Intervention Agent	n of Studies	Effect Size	95% CI	
			Low	High
Parent	3	1.35	0.56	2.14
Teacher	5	0.84	0.21	2.60
Parent & Teacher	6	0.29	-0.29	0.88
Computer	2	0.36	0.61	1.34

Table 7. Predictor Variable Correlations

Variable	Outcome	Relationship (average r)
Alphabet Knowledge (AK)	Decoding	.50
	Reading Comprehension	.48
	Spelling	.54
Phonological Awareness (PA)	Decoding	.40
	Reading Comprehension	.44
	Spelling	.40
Rapid Naming	Decoding	.40
	Reading Comprehension	.43
	Spelling	.31
Writing or Name Writing	Decoding	.49
	Reading Comprehension	.33
	Spelling	.36
Phonological Short Term Memory	Decoding	.26
	Reading Comprehension	.39
	Spelling	.31

Applying the Evidence

The results of the NELP (2008) report indicate code-focused interventions that included both phonemic awareness (PA) and phonics training were the most effective intervention strategies in increasing PA, AK, oral language, reading, and spelling skills, as shown in Table 4. It was concluded that shared book reading resulted in a significant positive effect on vocabulary skills. At the most general level of interpretation, the NELP data suggested that PA combined with phonics training would be most helpful to increase Samuel's pre-literacy skills, whereas shared book reading offers the most potential to increase his vocabulary skills; however, a substantial caveat remains. The more studies (i.e., participants) included in a systematic review and meta-analysis, the more likely the results are to be reliable and valid. When only a few studies with a small number of participants are available, the results must be interpreted cautiously. Although positive effects were found for many of the analyses included in the NELP report, many of these analyses included fewer than five studies and the NELP report did not report how many participants were included in the individual studies. In the absence of this basic information, it is very difficult to hold out the results as a definitive statement of the intervention effects. It is essential to examine the quality of the information related to the participant characteristics available in the individual studies and summarized in the report. When the quality of the information about the participants (e.g., age, gender, ability level) is absent or not well-reported, it is difficult, if not impossible, to generalize the findings beyond the individual study participants.

Although Janice and Maria have answered some of their questions, one important question remains to be answered: What will the intervention approach look like when used with Samuel? Based on their review of the evidence, Janice and Maria decided that shared storybook reading would have the greatest potential to help develop Samuel's vocabulary skills, and code-focused interventions that include PA and phonics would be most effective in developing Samuel's pre-literacy skills. The NELP (2008) report lacked the analysis of key intervention characteristics that would have helped Janice and Maria construct an intervention program for Samuel, such as:

- length of instructional program
- length of instructional sessions

- frequency of instructional sessions
- number of participants in an instructional session
- sequence of instructional targets
- agent of intervention for code-focused interventions.

Without these components in the NELP report, Janice and Maria will need to rely on their clinical experience and expertise to guide them in developing and delivering a treatment program.

Summary

The scenario described in this paper highlights a couple of important considerations an SLP may face in implementing an evidence-based intervention. First, one of the potentially comprehensive, high quality, and relevant resources may be in the form of a government panel report, such as the NELP (2008) report. These reports are often readily accessible via the internet and have been produced specifically to inform practice issues across disciplines and professionals. See also the report of the National Literacy Panel, 2000 and the RAND report (Snow, 2002).

Second, individual primary research studies or systematic reviews/meta-analyses do not and cannot provide complete answers to all clinical questions. Although the decisions Janice and Maria will make about the intervention strategy that may be most effective for Samuel are generally supported in the research, information about the specific characteristics of the details of the components of the interventions were not always clear or available and any application to a caseload will have to rely on both the available research and the professional's clinical experience and expertise to make decisions about how best to organize, deliver and evaluate the intervention of interest.

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