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Research Article

The Impact of Teacher Responsivity Education on Preschoolers' Language and Literacy Skills

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Purpose: This study examined the extent to which teacher responsivity education affected preschoolers' language and literacy development over an academic year. Additional aims were to determine whether children's initial language abilities and teachers' use of responsivity strategies were associated with language outcomes, in particular.
Method: In this randomized controlled trial, preschool centers were assigned to a responsivity education intervention (n = 19 centers, 25 teachers, and 174 children) or a "business-as-usual" control condition (n = 19 centers, 24 teachers, and 156 children). Teachers within the intervention centers received training focused on a set of strategies designed to promote children's engagement and participation in extended conversational interactions across the school day.
Results: Hierarchical linear models showed no main effects on children's language skills, although moderating effects were observed such that the intervention appeared to have positive effects for children with relatively high initial language abilities. In addition, teacher use of responsivity strategies was positively associated with vocabulary development. With regard to children's literacy skills, there was a significant main effect of the intervention on print-concept knowledge.
Conclusions: Although teacher responsivity education is viewed as benefitting children's language and literacy development, the impacts of this type of intervention on children's skills warrant further investigation.

Key Words: oral language, emergent literacy, preschool, intervention, professional development

Children's early oral language ability is arguably one of the more critical areas of development underlying academic success, particularly with regard to later reading achievement (Catts, Fey, Zhang, & Tomblin, 1999; NICHD Early Child Care Research Network, 2005; Storch & Whitehurst, 2002). However, observational research suggests that many preschool classrooms do not provide an optimum environment for facilitating children's language skills, particularly those serving children from low socioeconomic status (SES) backgrounds (e.g., Dickinson, Darrow, & Tinubu, 2008; Justice, Mashburn, Hamre, & Pianta, 2008). For instance, young children may have little opportunity to participate in multiturn conversations with their teachers, and their teachers may seldom provide explicit facilitation of children's language skills through such techniques as questioning, modeling, and recasting (Justice, Mashburn, Hamre, & Pianta, 2008). High-quality preschool language experiences, however, are especially critical for children from disadvantaged backgrounds and may serve to lower the incidence of risk among these children (Dickinson & Tabors, 2001; Hubbs-Tait et al., 2002).

Although implementation of high-quality language instruction within preschool programs appears to be an important means for promoting young children's language skills (e.g., Connor, Morrison, & Slominski, 2006; Justice, Mashburn, Pence, & Wiggins, 2008; Wasik & Bond, 2001), the literature on how to achieve higher quality language instruction in preschool settings is, in fact, quite limited. While some studies of professional development of teachers have shown sizable impacts on preschoolers' oral language skills, the training provided to teachers often occurs at an intensity and sustainability level that may lack feasibility for "real-world" practical settings (e.g., Girolametto, Weitzman, & Greenberg, 2003; Landry, Swank, Smith, Assel,

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& Gunnewig, 2006; Wasik, Bond, & Hindman, 2006). Identifying effective yet practical means for elevating the quality of language instruction within preschool classrooms is of import to both researchers as well as speech-language pathologists (SLPs) who are increasingly called on to support the language learning environments in school settings. One promising approach is training preschool educators to be more conversationally responsive to children within the classroom setting. The purpose of this randomized controlled trial (RCT) was to examine the extent to which yearlong responsivity education for preschool teachers affected the language and literacy performance of children in their classrooms. Our approach to responsivity education was modified for potential scalability from prior implementations that appear in the literature (e.g., Girolametto & Weitzman, 2007) and thus offers a unique evaluation of whether this approach to training educators can be tailored from more intensive approaches.

Responsivity Education

Responsivity education refers to training adults, including parents and educators (e.g., day care providers), to increase their capacity to be conversationally responsive partners with children. Adults who are conversationally responsive seek to promote "reciprocal interactions" that support the child's active participation in an exchange (Landry, Smith, Miller-Loncar, & Swank, 1997, p. 1040). Adults promote reciprocity in exchanges in a variety of ways that include emotional responsivity (e.g., smiling and maintaining eye contact), linguistic responsivity (e.g., consistently responding to children's communication efforts and recasting or expanding children's productions), and interactive responsivity (e.g., cuing the child to take another turn, using a slow pace so as to not dominate, and asking open-ended questions; Girolametto & Weitzman, 2002; Landry et al., 1997; Yoder & Warren, 2002).

While a number of studies have addressed the relations between characteristics of the language to which children are exposed (e.g., complexity of syntax used by children's mothers and teachers; see Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002) and their rate of language acquisition, recent treatments of this topic suggest that participation in conversations—particularly conversations that involve multiple reciprocal turns between child and adult—is an important mechanism for facilitating children's early language growth (see Zimmerman et al., 2009). Relatedly, a number of studies have shown positive associations between adults' conversational responsiveness and the amount and complexity of talk produced by young children during adult–child conversational exchanges; this literature has included studies involving both parents and educators, as we noted previously (Girolametto, Hoaken, Weitzman, & van Lieshout, 2000; Girolametto & Weitzman, 2002; Girolametto, Weitzman, van Lieshout, & Duff, 2000; Rush, 1999). For instance, preschool children's mean length of utterance is positively and significantly associated with the number of responsive behaviors that their teachers use during small-group play-based interactions (Girolametto & Weitzman, 2002). Adult conversational responsiveness also has been associated with accelerated language growth for both toddlers and preschoolers (e.g., Bornstein & Tamis-LeMonda, 1989; Landry et al., 1997; Tamis-LeMonda, Bornstein, & Baumwell, 2001). On the basis of such findings, conversational responsivity has often been a training target for parents (e.g., Yoder & Warren, 2002).

Experimental Studies of Responsivity Education in the Preschool Classroom

Despite evidence suggesting that conversationally responsive strategies are related to children's language development, there have been relatively few experimental studies of teacher responsivity education in preschool classrooms that examine its impact on children's language performance among typically developing children. We identified two types of approaches to responsivity education training in the extant literature, namely a comprehensive curricular approach versus a curricular supplement.

Justice, Mashburn, Pence, and Wiggins (2008) examined the impact of the Language-Focused Curriculum (Bunce, 1995), a comprehensive curriculum that involves teachers' use of responsivity strategies throughout a range of specific activities. These researchers examined effects of the curriculum on children's expressive language skills, with 14 teachers randomly assigned to the treatment or control condition (n = 196 children). Children ranged in age from 48 to 59 months and demonstrated risk for later academic difficulties, with all programs prioritizing enrollment for low-SES children. Treatment teachers received responsivity education training via a fall and winter workshop as well as access to the curriculum, which included daily lesson plans and materials for implementation. Interestingly, although treatment teachers showed high fidelity to some aspects of the curriculum, they showed relatively low fidelity to the use of responsivity strategies (see Pence, Justice, & Wiggins, 2008). The intervention results indicated no main effects of the intervention on preschool children's expressive language skills at the end of an academic year, although children's exposure to the intervention (as measured by attendance) moderated the treatment effect, such that children who received the intervention and had higher attendance rates demonstrated greater gains in language skills over the academic year.

Experimental studies have also examined responsivity education as a curricular supplement that is layered across any in-place curriculum. For instance, the Hanen Centre's Learning Language and Loving It (Weitzman & Greenberg, 2002) requires no specialized classroom materials and can be readily integrated into any existing preschool curriculum. This supplement is not a scripted approach but rather involves teaching educators a set of strategies they can use to be more conversationally responsive across daily classroom activities (Girolametto et al., 2003). Several studies have sought to address the effectiveness of this supplemental approach to elevating the language learning environment of preschool classrooms. For example, in an evaluation conducted on an early version of Learning Language and Loving It (Weitzman, 1992), Coulter and Gallagher (2001) randomly assigned two nursery schools in the United

Kingdom to intervention and control conditions (n = 23 teachers and 104 children whose ages ranged from 40 to 50 months). The SES of the participating children is unclear, but the study description did not imply that the participating centers served a high-risk population. The intervention teachers participated in intensive professional development (15 sessions plus individual modeling sessions). Results indicated that the intervention did not have a significant impact on children's expressive or receptive language ability or literacy skills (i.e., rhyme). However, there were two significant limitations of this work. First, the analyses failed to encompass the hierarchical structure of the data, in which children were nested in classrooms when receiving the intervention. Data from each child in the study were considered to be independent sources of information about the intervention's effects, a methodological limitation that can lead to inaccurate inferences. Second, children's outcomes were measured after only a very short course of exposure to the intervention once their teachers had completed the training (by our estimates, about 1 to 2 months). It is not clear that this is sufficient exposure to teachers' implementation of responsive strategies for children to exhibit a benefit, particularly given some work that has shown teachers increase their uptake of conversationally responsive strategies over time (Pence et al., 2008).

Although Coulter and Gallagher's (2001) findings raise questions about the effectiveness of responsivity education for educators, a more recent evaluation suggested that benefits from this approach are apparent for children's language complexity and productivity. Girolametto et al. (2003) randomly assigned four Canadian metropolitan day care centers to receive the intervention or control conditions (n = 16 teachers and 64 children whose age ranged from 18 to 67 months). The extent to which the children exhibited risk due to poverty is unclear. Teachers in the intervention condition were instructed to use conversationally responsive strategies within an intensive model of professional development that included a 14-week training period with eight 2.5-hr group sessions. In addition, teachers received six individual sessions with the SLP who led the group sessions. Each individual session featured on-site videotaping and coaching during small-group conversational interactions, immediately followed by joint viewing of the videotape with feedback provided by the SLP. Treatment teachers showed significantly greater gains than control teachers on four of five responsivity strategies measured (i.e., waiting for initiations, being face to face, taking turns together, and encouraging interaction in group situations); however, a great deal of individual variability characterized the teachers with respect to the specific strategies used following the professional development intervention. No standardized tests of children were collected; instead, assessments of child outcomes were language-sample analyses implemented during small-group interactions. Implemented at only the group level (child data were aggregated to the level of the group), children whose teachers received responsivity education demonstrated increased language productivity, complexity, and peer initiations as compared to children whose teachers did not receive responsivity education. The authors argued that the impacts on children's verbal productivity was a critical finding, as more child talk provides increasing opportunities for children to elicit advanced language models from adults and peers (Girolametto, Weitzman, & Greenberg, 2006).

Purpose of This Study

The need to promote the language learning environment of preschool classrooms is well documented in the literature (Dickinson et al., 2008; Dickinson & Tabors, 2001; Justice, Mashburn, Hamre, & Pianta, 2008; Pence et al., 2008). Indeed, professional development of the early education workforce is a promising approach toward addressing this need, and rigorous investigation of the efficacy and effectiveness of programs available to support this effort is an important focus of educational research. Training early educators in how to better their responsively oriented interactions with children provides a welcome contribution to an emerging literature that is increasingly focused on equipping teachers with static programs that provide little attention to the importance of teacher–child interactions in fostering language development (e.g., Fischel et al., 2007). Nonetheless, the extent to which teacher responsivity education results in improved language development for children is unclear based on the existing literature. Although a curricular supplement approach is particularly intriguing, given that materials are fully developed, readily available, and potentially assimilable into any existing preschool curriculum/orientation, the available research on this approach is generally mixed. At the same time, prior research on this approach also appears to have involved a general population of preschool children rather than those for whom such an approach might be particularly advantageous, namely children who exhibit lags in language development due to SES.

To this end, the present study describes child outcomes, including both main and moderated effects, associated with their teachers' participation in responsivity education. The study differs in several key ways from prior reports of responsivity education, namely that (a) participating teachers comprised a relatively large sample of early childhood educators (49 teachers) who came from diverse workplace settings (e.g., Head Start and publicly funded prekindergarten); (b) participating children (n = 330) came primarily from low-SES backgrounds, and many exhibited relatively low standardized language scores at the start of the study; (c) the intervention implementation featured a curricular supplement assimilable into any existing preschool classroom with a reduction in intensity of training to potentially improve the external validity of this approach; and (d) a broad array of child outcomes were measured, encompassing indices of both oral language and emergent literacy. Emergent literacy skills were measured because the intervention materials included explicit attention to using responsivity not only to foster language skills but also to promote emergent literacy skills during interactive storybook reading. In addition, as part of our intervention, we included content in the professional development of teachers that emphasized the

importance of talking to children about print during literacy-related activities (see also Girolametto, Weitzman, Lefebvre, & Greenberg, 2007).

Three research questions were addressed in this experimental study:

1. To what extent does preschool teachers' participation in responsivity education increase the language and literacy skills of children in their classrooms?
2. To what extent are the effects of responsivity education on children's language skills moderated by their entry-level language skills?
3. To what extent is there a relationship between teachers' frequency of use of specific responsivity strategies and children's language development over the academic year?

The reasoning behind the first question is self-explanatory, given the emphasis on estimating main effects attributable to the intervention, but we mention briefly our rationale for including the second and third questions. Regarding the second question, prior research on treatment effects affiliated with parental implementation of responsivity strategies found that effects varied as a function of child characteristics (Yoder & Warren, 2002). Specifically, the treatment was differentially effective for toddlers with intellectual disabilities based on the language skills that they brought to treatment; in fact, parental use of conversationally responsive strategies was beneficial only for those children who began treatment with higher levels of skill (similar trends have been reported elsewhere: Justice et al., 2010; Mashburn, Justice, Downer, & Pianta, 2009; Penno, Wilkinson, & Moore, 2002; but see Justice, Meier, & Walpole, 2005). Therefore, we specifically questioned whether differences based on children's individual abilities would be apparent in this classroom-based intervention as well.

Regarding the third question, prior research has suggested that responsivity education does not result in full differentiation between treated and untreated teachers (Pence et al., 2008). Using assigned conditions (treatment vs. control) as a between-subjects factor may mask overlaps in treatment implementation because some treatment teachers will not fully implement intervention strategies, and some control teachers will use the strategies naturally. This may be less a result of professional development ineffectiveness and more a result of natural utilization of some level of responsivity strategies by untrained teachers (Kaderavek & Justice, 2010). With our third question, we investigated the presumed "active ingredients" of the intervention (i.e., teachers' frequency of use of specific strategies) and their relationship to children's language development.

Method

Research Design

This RCT investigated the impact of a classroom-based language intervention on preschool children's oral language and emergent literacy skills as implemented by their classroom teachers. Data were collected for two sequential cohorts in one mid-Atlantic state across 2 academic years (2005–2006 and 2006–2007). Stratified by region, 38 preschool centers were randomly assigned to conditions, resulting in 19 centers (25 teachers) assigned to the intervention condition and 19 centers (24 teachers) assigned to the control condition. Although centers were the unit of random assignment in this study, to prevent contamination if two teachers in one center implemented competing conditions, it is important to note that only five of the 38 centers had more than one teacher enrolled. Therefore, in most cases, the classroom/teacher-level unit is redundant with the center-level unit. We discuss this below in the *Analytic Strategy* subsection.

Teachers assigned to the intervention condition completed professional development focused on responsivity as adapted from Learning Language and Loving It. Teachers in the control condition engaged in "business-as-usual" practices, maintaining their prevailing educational practices. Across both conditions, teachers simultaneously used a range of general classroom curricula, and these were not manipulated in any way. Most intervention (n = 20) and control teachers (n = 23) reported using the Creative Curriculum for Preschool (Dodge, Colker, & Heroman, 2002). Three intervention teachers used High/Scope (Hohman & Wikhart, 1995), and one teacher reported using both curricula simultaneously. Several teachers also reported using additional curricula, and data were unavailable for 2 teachers.

Participants

Twenty-seven centers were Head Start programs, and 11 centers were part of a state-funded prekindergarten program delivered in public elementary schools. All programs were publicly funded and designed to provide center-based education experiences to children from low-SES backgrounds or those who exhibited specific risk factors (e.g., low parent education, homelessness, or health/developmental problems). Centers were dispersed throughout the state, and census data identified 16 centers as urban, 12 centers as suburban, and 10 centers as rural.

Classroom teachers (N = 49) were primarily female (96%), and most were Caucasian (67%). Nearly one quarter of the sample was Black/African American (22%), and 2% did not report their race/ethnicity. Most teachers held a post-high school degree, such as a master's degree (22%), bachelor's degree (33%), or associate degree (37%), and 4% reported a high school diploma as their highest degree (4% unreported). On average, teachers had 11.8 years of experience (SD = 7.4), with much of their experience at the preschool level (M = 9.5, SD = 6.7). There were no statistically significant differences between intervention and control conditions with regard to teachers' race/ethnicity, $\chi^2(1, N = 47) = 0.30, p = .59$; level of education, $\chi^2(2, N = 47) = 3.25, p = .20$; or years of experience, $F(1, 45) = 0.91, p = .35$. (Three additional teachers were initially enrolled in the study but withdrew during the academic year; consequently, we did not include these teachers or their students in analyses.)

A total of 330 children (174 male and 156 female) also participated in this study. Five to eight target children from each of 49 teachers' classrooms were randomly selected from those for whom consent was received and who met an age eligibility criterion of 3 years, 4 months, by October of the study year. (Two children were retrospectively removed from the study for failure to meet the age criteria. Their data were not included in analyses.) In total, 168 children were enrolled in the intervention classrooms, and 162 were enrolled in control classrooms. Children's mean age at the start of the study (October 1) was 52 months (SD = 5.5, range = 40–66), and children's race/ethnicity was primarily Caucasian (44.5%) or Black/African American (33.3%). (Race/ethnicity information was not obtained for 9.1% of children.) The sample was composed of primarily English-speaking children (as reported by 97% of parents who returned surveys), with very few parents reporting that their children did not speak English at home (2.7%) and 84.8% reporting that their preschoolers spoke English at home (12.4% unreported). Annual household income was reported as ≤$25,000 for 55.5% of children, with 27.9% of children living in households in which the income from all sources was ≤$10,000 (21.5% unreported). The highest degree held by the majority of mothers was high school (52.1%), and 18.5% did not complete high school (20.9% unreported). Teachers reported that 15.5% of children had individualized education programs (unreported for 15.5% of children). For 47.6% of children, this school year represented their first year in preschool (19.7% unreported). Table 1 presents demographic information for participants by condition.

There were no statistical differences between the children in the intervention and control conditions with regard to age, $F(1, 328) = 0.11$, $p = .74$; gender, $\chi^2(1, N = 330) = 1.02$, $p = .31$; highest level of maternal education, $\chi^2(3, N = 261) = 5.02$, $p = .17$; or initial language ability as measured by a language composite of three subtests from the Clinical Evaluation of Language Fundamentals Preschool—Second Edition (CELF Preschool–2), $F(1, 269) = 0.77$, $p = .38$ (Wiig, Secord, & Semel, 2004). However, there was a trend indicating that the groups appeared somewhat different with regard to race/ethnicity, $\chi^2(1, N = 300) = 3.41$, $p = .07$, and the presence of an individualized education program, $\chi^2(1, N = 279) = 3.20$, $p = .07$. The intervention group included more Black/African American and Hispanic children and fewer Caucasian children than expected by chance, while the control group had slightly more children with an individualized education program than expected. In addition, there was a significant difference among children in terms of their prior preschool experience. For those children in the intervention classrooms, more than expected were enrolled in their first year of preschool. In contrast, in the control classrooms, more children than expected had attended a preschool program in the previous year, $\chi^2(1, N = 265) = 5.78$, $p = .02$.

TABLE 1. Child demographic information for intervention (n = 168) and control (n = 162) conditions.

Variable	Intervention *n* (%)	Control *n* (%)
Child gender		
Male	84 (50.0%)	90 (44.4%)
Female	84 (50.0%)	72 (55.6%)
Race/ethnicity		
African American	60 (35.7%)	50 (30.9%)
Caucasian	66 (39.3%)	81 (50.0%)
Hispanic	13 (7.7%)	4 (2.5%)
Multiracial or other	12 (7.1%)	14 (8.6%)
Unreported	17 (10.1%)	13 (8.0%)
Annual household income		
$10,000 or less	52 (31.0%)	40 (24.7%)
$10,000–$25,000	43 (25.6%)	48 (29.6%)
$25,000–$50,000	24 (14.3%)	28 (17.3%)
Over $50,000	13 (7.7%)	11 (6.8%)
Unreported	36 (21.4%)	35 (21.6%)
Highest level of maternal education		
Less than high school degree	37 (22.0%)	24 (14.8%)
High school degree only	40 (23.8%)	37 (22.8%)
Some college	43 (25.6%)	52 (32.1%)
Post-high school degree	11 (6.5%)	17 (10.5%)
Unreported	37 (22.0%)	32 (19.8%)
Year in preschool		
First year	89 (53.0%)	68 (42.0%)
Not first year	45 (26.8%)	63 (38.9%)
Unreported	34 (20.2%)	31 (19.1%)
Individualized education program		
Yes	20 (11.9%)	31 (19.1%)
No	121 (72.0%)	107 (66.0%)
Unreported	27 (16.1%)	24 (14.8%)

Attrition and Missing Data

In terms of attrition, 21 children left their preschool program during the school year, leaving 309 children remaining as study participants in the spring of the year. Given the length of the total assessment battery given to children, and the fact that this was implemented over multiple days with individual children, there was occasional missing data on one or several measures for individual children. The primary reasons for missing data included child absence on the day of assessment or child dissent. Children were included in analyses only if both fall and spring scores for the relevant assessment outcome were available. Thus, sample sizes varied per assessment outcome. For each outcome, statistical comparisons made between those included in the analyses and those not included in the analyses were not significant in terms of maternal education or initial language ability (all ps > .06).

General Procedure

To recruit participants, information about the study was provided to preschool center administrators and/or school principals. Teachers were invited to attend a session in which the study was introduced and the consent procedure was explained. Teachers consenting to participate in the study then sent recruitment flyers and consent forms to the parents of children in their classrooms. Children were randomly selected into the study from among those for whom consent to participate was received.

Direct measures of children's language and emergent literacy skills were administered in the fall and the spring of the school year. Assessments were individually administered

in a quiet school setting and took place during a 6-week window conducted early in the fall and late in the spring. All assessors were comprehensively trained utilizing a four-step process per measure administered: (a) assessors viewed an online training module that presented detailed administration information along with videos of administration models; (b) assessors scored at least 85% on a written quiz about the measure; (c) assessors observed administration in the field by a skilled assessor; and (d) assessors were supervised during the initial administration. Prior to the subsequent assessment waves, all assessors completed a refresher training, which consisted of the first two steps outlined above.

Intervention Design

Intervention condition. The professional development package for teachers in the intervention condition contained two components: (a) direct training designed to increase teachers' conversational responsivity in the classroom and (b) access to a consultant who provided off-site coaching throughout the academic year. The professional development program was adapted from Learning Language and Loving It (Weitzman & Greenberg, 2002) with permission from the Hanen Centre. The program comprises eight distinct sessions, each focused on engaging children in conversation and providing enriching opportunities to stimulate their language. Specific responsivity strategies are described, such as taking turns with children in conversations and asking questions. Training materials from the Learning Language and Loving It leader's guide were utilized to include PowerPoint slides, video demonstrations, and teacher role-playing activities; primary adaptations included condensing of the program content for delivery via fall and winter workshops and omitting sections pertaining to infant/toddler development. A further adaptation included the schedule followed in the teacher training, as the program is designed for implementation of the sessions over multiple weeks (e.g., one session per week for 8 weeks). However, for the purposes of this study, an alternative training schedule was followed to facilitate the program's use with a large, diverse, and geographically distributed sample of teachers. Specifically, in the August preceding the start of the school year, five of the sessions were presented to intervention teachers in a 3-day in-service workshop (i.e., 13 hr of professional development). Separate workshops were held in each geographical location, with two research staff facilitating each workshop. Some facilitators were SLPs, and at least one of the two facilitators per session was certified by the Hanen Centre.

At this workshop, teachers were given the Learning Language and Loving It manual (Weitzman & Greenberg, 2002) along with in-depth training on the first five sessions: (a) Take a Closer Look at Communication, (b) Follow the Child's Lead, (c) Taking Turns Together, (d) Encouraging Interactions in Group Situations, and (e) Provide Information That Promotes Language Learning. Teachers also received a schedule of reading assignments to take place over the year, video-recording equipment, recording media, and training on how to use this equipment. In January, these teachers reviewed previous material and were provided with the remaining three sessions during a 1-day in-service workshop (i.e., 4 hr of professional development): (a) Let Language Lead the Way to Literacy, (b) Fostering Peer Interaction, and (c) Wrap-Up. (Note that training for the second cohort of teachers was slightly modified with regard to number of fall in-service days [i.e., 2 days] and presentation order of modules; however, total training time of 17 hr as well as content were identical to that received by the first cohort.) During this winter workshop, session content explicitly discussed use of conversationally responsive strategies within the context of interactive storybook reading.

The coaching component of our professional development was also modified for reduced intensity training; the original Learning Language and Loving It program includes six individual, on-site coaching sessions coupled with videotaping and immediate feedback to support implementation of conversationally responsive strategies. In the present study, classroom teachers in the intervention centers were assigned to a trained research assistant serving as a consultant. In some cases, the consultant also served as a facilitator for the large group workshops. The consultant's primary role was to view videos submitted throughout the year (discussed in the next paragraph) and to provide written feedback to the teachers regarding their implementation of intervention strategies. This feedback documented what teachers did well, considerations for reflection on their use of the strategies, and suggestions for improving their use of the strategies. Teachers had access to their classroom consultants via e-mail throughout the year, but teacher–consultant communication outside of the written feedback was rare. Again, it is important to note that this level of consultation is much less intense than is recommended for use with Learning Language and Loving It and has typically been used with this intervention approach (Girolametto et al., 2003). It is also necessary to recognize that the level of consultation is less marked than is described in recent studies of consultation and mentorship (e.g., Landry et al., 2006). Nonetheless, it is also the case that this approach to training teachers (e.g., intensive fall workshop coupled with periodic consultation and refreshers) is commonly applied in both research and practice, and is quite practical.

Teachers were required to conduct 20-min videotaped recordings in their classrooms every 2 weeks demonstrating their use of specific conversationally responsive strategies from October through April of the academic year. A recording schedule was provided indicating the specific dates in which each video was to be recorded and the type of responsivity strategy and activity to be recorded (e.g., small group Play-Doh activity or storybook-reading activity). For approximately 1 month (i.e., two taping sessions), teachers were asked to focus on specific sets of strategies tied to the training sessions, designed to build incrementally: following the child's lead, taking turns together, providing information, encouraging interaction in group situations, letting language lead the way to literacy, and fostering peer interaction. Teachers were asked to read assigned pages from the Learning Language and Loving It manual and develop an action plan prior to each videotaping session. After the session, teachers were encouraged to review the videotape

and asked to reflect on their practices, and then submit their reflection along with the video to the research lab. Reflections were brief and included three prompts: (a) "I was happy that…" (e.g., *the children were in a mood to interact with each other in a calm manner*), (b) "I wish that I had…" (e.g., *asked more open-ended questions*), and (3) "I will now remember to…" (e.g., *position the reluctant child next to me if he won't talk to the other children*). In addition, teachers provided an example of how they implemented the target strategy (e.g., "I encouraged peer interaction by asking the children to share ideas or to help each other"). Feedback from consultants was typically given prior to the next taping, although there was some variability with regard to teacher adherence to the schedule. If at any point during the intervention year teachers were displaying difficulty in maintaining conversations with children, consultants continued to emphasize basic setup and communication-facilitating strategies along with the focal strategies. (Examples of consultant feedback are provided in supplementary material associated with this article.)

Control condition. Teachers assigned to the control condition also attended a 3-day August in-service workshop and a 1-day January workshop. However, professional development topics did not include conversationally responsive strategies. Instead, the topics included behavior management, storybook selection, adapting the classroom for children with special needs, and preschool math. Control teachers were also provided with and trained to use the video-recording equipment. An identical recording schedule was provided, and teachers submitted videos of specific classroom activities similar to those of the intervention teachers (without mention of responsivity strategy use). Control teachers were also given access to consultants who either provided generic feedback regarding best practices in early childhood education or no feedback apart from an acknowledgement that the tape was received. When provided with feedback, teachers had the opportunity to contact their consultant via e-mail.

Intervention Fidelity

Intervention fidelity was monitored via analysis of the videos that teachers submitted over the course of their study involvement. All teachers were requested to submit 12 videos over the course of the year to demonstrate their use of specific techniques. The majority of intervention teachers (17 of 25) submitted all 12 required videos throughout the year; of the remainder, six teachers submitted at least nine videos, one teacher submitted seven, and one submitted only three videos. As we discussed previously, research personnel viewed these videos and provided written feedback on a regular basis.

For purposes of fidelity assessment, three of the teachers' submitted videos were coded using an experimental tool adapted through analysis of the Hanen Centre's materials to provide a proximal measure of intervention implementation. These videos featured a common activity context (i.e., Play-Doh setting) and were selected to span the academic year (i.e., fall, winter, and spring). This tool, which used an interval-based system, coded the frequency with which teachers implemented the specific intervention strategies, to include two sets of responsivity strategies: (a) communication-facilitating strategies designed specifically to facilitate children's communication with their teachers and their peers, and (b) language-modeling strategies designed to provide advanced language models to children. The specific strategies within each category are listed in Table 2. Specifically, 30-s sequential segments of 7.5-min of each video were coded for each set of strategies; reliable coders identified presence or absence of each strategy within each interval. Because some intervals were uncodable (i.e., poor video quality or instances in which children's conversational turn occupied the entire interval), scores per strategy were averaged across intervals and then summed to create composites for each set of strategies. Prior to coding, research staff members were trained to 90% accuracy on three master-coded video segments; subsequently, a random sample of

TABLE 2. Conversational responsivity strategy use across conditions.

	Treatment	Control	Overall
Strategy	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Communication-facilitating			
Looks expectantly at children and is warm/receptive to encourage interaction	.94 (.09)	.84 (.18)	.89 (.15)
Uses slow/adequate pace to allow children to participate	.98 (.03)	.97 (.05)	.98 (.04)
Uses comments to cue another turn	.45 (.16)	.30 (.16)	.38 (.18)
Uses sincere/open questions to stimulate conversation	.43 (.17)	.32 (.14)	.38 (.17)
Facilitates peer-to-peer communication	.07 (.05)	.04 (.04)	.06 (.05)
Language-modeling			
Stresses and repeats words to make them salient	.08 (.07)	.15 (.10)	.11 (.09)
Repeats child's message with correct syntax/pronunciation, or repeats child's utterance and adds a word or phrase	.09 (.06)	.04 (.05)	.07 (.06)
Uses comments or questions to provide extra information/explanation about an object or a topic	.17 (.11)	.16 (.13)	.17 (.12)
Uses comments or questions to talk about feelings, to project or pretend, or to talk about the past/future	.04 (.06)	.01 (.02)	.03 (.05)

Note. Scores represent means across all cycles and fall/winter/spring time points (maximum score = 1.00).

10% of videos were double-coded, with 88% exact agreement between coders.

Fidelity averages, based on teachers' use of communication-facilitating and language-modeling strategies, were calculated across the fall, winter, and spring. Scores were available for 34 teachers at all three time points, for 13 teachers at two time points, and for two teachers at one time point. Overall, intervention teachers employed communication-facilitating responsivity strategies (maximum score = 5) at a greater rate across the year than those in control centers, $F(1, 36) = 18.52$, $p < .001$, $d = 1.39$; $M_{treatment} = 2.92$, $SD = 0.28$; $M_{control} = 2.51$, $SD = 0.30$, but there was no significant difference in the use of language-modeling strategies (maximum score = 4) between groups, $F(1, 36) = 18.52$, $p < .001$, $d = –0.05$; $M_{treatment} = 0.37$, $SD = 0.23$; $M_{control} = 0.38$, $SD = 0.19$. In Table 2, we present the item means and standard deviations across conditions for both communication-facilitating and language-modeling strategy use. Teachers in both conditions displayed high use of warmth and a slow pace to encourage conversational interactions. Of the communication-facilitating strategies, encouraging peer-to-peer interactions was rarely observed. Although use of all language-modeling strategies was extremely low, teachers demonstrated slightly more use of comments and questions to provide extra information about a topic. (Elsewhere, we describe changes in these strategies over time using growth curve analyses to provide a more in-depth treatment of effects on teacher behavior; Piasta et al., 2011.)

In the present study, we included teachers' use of communication-facilitating strategies in our analyses for Question 3, because this set of strategies appears to best differentiate the treatment and control teachers and is strongly associated with children's verbal productivity (e.g., Girolametto & Weitzman, 2002); this is presumably due to the fact that these strategies provide children the opportunity to practice their language skills within the context of everyday conversations.

Outcome Measures

Children were administered a battery of measures designed to address school readiness as broadly conceptualized (e.g., preacademic skills and social competence). Our purpose here was to examine the impacts of teacher training on children's language and literacy skills; consequently, the current research includes as outcomes a select set of five measures from a larger battery, two of which (grammar and alphabet knowledge) were composited from two interrelated measures to represent theorized constructs.

Children's *language skills.* Grammar was assessed via a composite of two subtests from the standardized, norm-referenced CELF Preschool–2 (Wiig et al., 2004). The Word Structure subtest (maximum score = 24) measures children's use of morphology, pronouns, tense, and prepositions. The Sentence Structure subtest (maximum score = 22) measures children's ability to comprehend complex sentence structures (e.g., "The boy has a ball"). Test–rest values for these subtests range from .78 to .90, and internal consistency is .83 and .78, respectively (Wiig et al., 2004). For each subtest, raw scores were transformed into *Z* scores (taking into consideration the distributions of both fall and spring scores) and summed to create a grammar composite per assessment time point. Receptive vocabulary was measured using the Peabody Picture Vocabulary Test—III (Dunn & Dunn, 1997); in this test, children are asked to choose an illustration from four alternatives that best matches a spoken target word. Test–retest reliability ranges from .91 to .94, and the test demonstrates strong internal consistency (Cronbach's $\alpha = .95$; Dunn & Dunn, 1997). The Expressive Vocabulary subtest of the CELF Preschool–2 (maximum score = 40) was used to measure children's ability to name objects, actions, and people. Test–retest values for this subtest range from .78 to .90; reported internal consistency for the subtest is .82 (Wiig et al., 2004).

Children's emergent literacy skills. Children's emergent literacy skills included print-concept knowledge and alphabet knowledge. Print-concept knowledge was measured using the 14-item Preschool Print and Word Awareness test (Justice, Bowles, & Skibbe, 2006), in which children are asked questions about book and print organization in the context of a storybook-reading activity. Test developers reported an interrater reliability coefficient of .94, and this measure represents a single trait with a reliability of .74 (see Justice et al., 2006).

Upper- and lowercase alphabet knowledge was measured using the Upper-Case Alphabet Knowledge and the Lower-Case Alphabet Knowledge tasks of the Phonological Awareness Literacy Screening for Preschool (Invernizzi, Sullivan, Meier, & Swank, 2004). Children were asked to name randomly ordered letters on an 8.5-in. × 11-in. page (maximum score per subtest = 26). Test developers reported an interrater reliability coefficient of .99 for each task. These subtests were summed to create composite scores for alphabet knowledge at both fall and spring time points.

Analytic Strategy

A multilevel structure characterized the data: 330 children were nested within 49 classrooms, which were nested within 38 centers. To account for the hierarchical data structure, we initially utilized three-level hierarchical linear modeling (HLM; Raudenbush & Bryk, 2002), which allowed for examination of child-level (Level 1), classroom-level (Level 2), and center-level (Level 3) components. Our preliminary model testing of a completely unconditional model (i.e., no covariates) indicated that a variance of 0 at the classroom level was observed on nearly all of the outcomes. Because of the low ratio of classrooms to centers, this was not surprising; advantageously, it also allowed us to test our models using two- rather than three-level models. All analyses were conducted employing HLM 6 software (Raudenbush, Bryk, & Congdon, 2004).

In all analyses, we used raw scores because they offer greater variability than standardized norm scores, consequently allowing for true detection of change/growth; in addition, raw scores are not adjusted for age. For each outcome, unconditional (i.e., without predictors) and base models were first estimated. The base model estimated the variance attributable in outcomes due to between-children and between-center differences, and included fall preintervention scores

entered as a grand-mean centered predictor at the child level. In this way, residualized gain in language and literacy outcomes was examined in all HLM models except the unconditional model.

Our first research question involved examining the main impact of the intervention on children's fall to spring gains and was addressed by adding intervention condition to the relevant base models. A dummy code representing the condition to which centers were assigned (1 = intervention, 0 = control) was included at the center level. A significant effect associated with the condition variable was interpreted as a reliable effect of intervention. Effect sizes (Cohen's *d*) were calculated in a manner consistent with the HLM results. The coefficient associated with the dummy coded condition variable was used as the numerator, as this represents the difference in residualized gains between children in the intervention and control conditions. The pooled standard deviation of the outcome variable was used as the denominator.

We addressed our second question concerning children's initial language ability as a potential moderator of intervention effects on children's oral language by including the interaction of intervention condition and children's fall language scores in the model. Specifically, a dummy code representing condition was included at the center level (as described above), children's fall language scores were included at the child level, and the cross-level interaction between these variables was also modeled. A significant interaction effect indicated that effects of intervention differed based on children's initial language scores.

Finally, we addressed our third research question regarding the relationship between teacher use of responsivity strategies and children's language development by adjusting our main effects model described above (i.e., Research Question 1). We substituted the condition variable with a variable representing the extent to which teachers used communication-facilitating strategies. We did not examine the association between language-modeling strategies and children's language development because language-modeling strategy use was very low, thus limiting variability due to the restricted range. It is important to note that in addressing this question, we were no longer testing the effects of treatment condition but were examining relations between children's language development and the presumed "active ingredients" of the intervention, for which there was likely overlap between treatment and control conditions. Because this variable was unassigned, results cannot be interpreted causally.

For all models, a Benjamini–Hochberg correction (Benjamini & Hochberg, 1995) was applied to statistically significant effects. The use of multilevel modeling served as a method to control the Type I error rate to account for clustering; however, when simultaneously testing for treatment effects across multiple outcomes, it is critical that a correction is applied to statistically significant findings (What Works Clearinghouse, 2008).

Results

Missing data for the sample were assessed for each individual outcome variable. Because attrition in randomized experiments may create dissimilarities between treatment and control samples, it is important to assess the extent to which attrition contributed to a potential bias of estimated treatment effect. Level of bias was examined through a comparison of the overall proportion of missing data for a given outcome compared to the differential proportion of missing data between treatment and control groups. Using guidelines outlined by What Works Clearinghouse (2008), we determined that the relationship between total missing and differential missing data for each outcome was at an acceptable level of bias under conservative assumptions.

Table 3 presents descriptive statistics for the full sample of children ($N = 330$) on all measures of oral language and emergent literacy. Of the children for whom an initial language composite score percentile rank, derived from grammar and vocabulary subtests of the CELF Preschool–2, was available ($N = 269$), 65.4% performed at or below the 25th percentile in comparison to a norm-referenced sample, with 50.6% of the 269 children performing at or below

TABLE 3. Means (and standard deviations) per outcome for children in full sample, intervention condition, and control condition.

	Full sample			Intervention			Control		
Measure	*N*	Fall	Spring	*n*	Fall	Spring	*n*	Fall	Spring
Oral language									
Grammar (sentence structure)	237	10.78 (4.82)	13.55 (4.87)	121	10.74 (4.64)	13.54 (4.79)	116	10.84 (5.02)	13.56 (4.98)
Grammar (word structure)	231	9.86 (5.19)	13.02 (5.49)	116	9.53 (4.93)	13.06 (5.50)	115	10.18 (5.44)	12.98 (5.50)
Receptive vocabulary	240	43.42 (19.35)	54.39 (19.75)	122	42.10 (19.06)	54.66 (20.99)	118	44.80 (19.63)	54.11 (18.46)
Expressive vocabulary	229	14.63 (7.94)	19.24 (8.53)	116	14.64 (7.60)	19.21 (8.57)	113	14.63 (8.31)	19.27 (8.52)
Emergent literacy									
Print-concept knowledge	234	5.31 (3.35)	8.05 (3.67)	120	5.23 (3.40)	8.66 (3.66)	114	5.39 (3.31)	7.40 (3.59)
Uppercase alphabet	251	6.78 (7.99)	14.09 (10.01)	130	6.53 (7.84)	14.41 (10.08)	121	7.06 (8.17)	13.75 (9.96)
Lowercase alphabet	247	4.50 (6.64)	11.45 (9.43)	128	4.27 (6.39)	12.43 (9.58)	119	4.74 (6.93)	10.40 (9.19)

Note. Grammar (sentence structure and word structure) and expressive vocabulary scores from Clinical Evaluation of Language Fundamentals Preschool—Second Edition (Wiig et al., 2004), maximum = 22, 24, 40, respectively; receptive vocabulary from Peabody Picture Vocabulary Test—III (Dunn & Dunn, 1997), maximum = 204; print-concept scores from Preschool Print and Word Awareness Test (Justice et al., 2006), maximum = 17; upper/lowercase alphabet scores from Phonological Awareness Literacy Screening for Preschool (Invernizzi et al., 2004), maximum = 26 per subtest.

the 16th percentile. Average initial language was slightly more than –1 *SD* of the mean at 83.63, and only 38 children in the sample scored above a standard score of 100. These descriptive data imply that the participants in this study exhibited relatively low language skills in relation to normative references. These data also suggest that for the children in this study, exposure to a high-quality language intervention implemented by their teachers may be particularly important.

Table 3 also displays the means and standard deviations for children in the intervention and control conditions in both the fall and spring. Intraclass correlations (ICCs) estimated from the unconditional models provide the proportion of variance in outcomes attributable to differences between centers and between children (i.e., within centers; see Table 4). At the center level, ICCs ranged from .003 on receptive vocabulary to .25 on alphabet knowledge. These values indicate that the majority of variance lay between children.

The first research aim was to examine the extent to which teacher implementation of the yearlong classroom-based language intervention affected children's oral language and emergent literacy development across the preschool year. We first examined the main impact of the intervention on children's gains in grammar and receptive/expressive vocabulary. As indicated in Table 4, main intervention effects were not apparent for any language outcome. It is important to note, however, that children's fall language scores consistently predicted spring language scores for each outcome (all ps < .001), suggesting that children's language skills appear to maintain considerable stability during the preschool year. Next, we explored the extent to which the intervention affected emergent literacy outcomes. Dependent variables included print-concept knowledge and alphabet knowledge. Table 5 displays full results of the two models. Main effects of the intervention were found for print-concept knowledge (p = .004) but not for alphabet knowledge (p = .102). Thus, children whose teachers implemented the intervention exhibited significantly higher levels of print-concept knowledge skills.

The second research aim addressed whether effects of the intervention, focusing specifically on the language outcomes, were moderated by children's language ability at the beginning of the school year. Building on the base model, we tested the cross-level interaction between condition and fall language ability for each oral language outcome (i.e., grammar, receptive vocabulary, and expressive vocabulary). Although the results were not significant when applying the Benjamini–Hochberg correction (critical value of .0167), the model results (p = .023) raise the possibility that children's fall language ability moderated the intervention effect for expressive vocabulary skills, a finding that is plausible based on prior research (Yoder & Warren, 2002). Moderated results were not significant for any other language variable. (See full results in Table 6.) Given the possibility that chance alone was not driving the observed relations between children's fall language ability and intervention responsiveness, Figure 1 graphs this interaction to show that within the intervention condition, children with higher initial language skills appeared to derive greater benefit from intervention compared to those with lower skills.

TABLE 4. Hierarchical linear modeling (HLM) results showing impact of intervention on children's oral language gains.

Parameter	Fixed effects				Random effects				Base ICC (between-center variability)
	Coefficient	*SE*	*df*	*p*	Estimate	χ^2	*df*	*p*	
Grammar									
N = 228 children, 38 centers									
d = 0.10									
Intercept (γ_{00})	0.51	0.16	36	.004					.058
Child-level (r)					1.26				
Fall score (γ_{10})	0.78	0.04	225	<.001					
Center-level (u_0)					0.15	66.61	36	.002	
Intervention condition (γ_{01})	0.17	0.21	36	.42					
Expressive vocabulary									
N = 229 children, 38 centers									
d = 0.05									
Intercept (γ_{00})	18.69	0.87	36	<.001					.19
Child-level (r)					20.82				
Fall score (γ_{10})	0.87	0.04	226	<.001					
Center-level (u_0)					4.79	79.11	36	<.001	
Intervention condition (γ_{01})	0.26	0.95	36	.78					
Receptive vocabulary									
N = 240 children, 38 centers									
d = 0.13									
Intercept (γ_{00})	52.34	1.14	36	<.001					.003
Child-level (r)					163.39				
Fall score (γ_{10})	0.79	0.04	237	<.001					
Center-level (u_0)					0.43	36.90	36	.43	
Intervention condition (γ_{01})	2.30	1.57	36	.15					

Note. ICC = intraclass correlation.

TABLE 5. HLM results showing impact of intervention on children's emergent literacy gains.

Parameter	Fixed effects				Random effects				Base ICC (between-center variability)
	Coefficient	*SE*	*df*	*p*	Estimate	χ^2	*df*	*p*	
Print-concept knowledge *N* = 234 children, 36 centers *d* = 0.39									
Intercept (γ_{00})	7.19	0.31	34	<.001					.05
Child-level (*r*)					9.01				
Fall score (γ_{10})	0.57	0.05	231	<.001					
Center-level (u_0)					0.45	45.37	34	.09	
Intervention condition (γ_{01})	1.44	0.45	34	.004					
Alphabet knowledge *N* = 246 children, 38 centers *d* = 0.24									
Intercept (γ_{00})	25.06	1.34	36	<.001					.25
Child-level (*r*)					156.62				
Fall score (γ_{10})	0.81	0.08	243	<.001					
Center-level (u_0)					40.71	113.35	36	<.001	
Intervention condition (γ_{01})	4.66	2.78	36	.10					

To test this interpretation of the interaction effect, we statistically analyzed whether there was an intervention effect for children with initial language scores above the mean (i.e., above relative average) versus those below the mean (i.e., below relative average). Thus, the fall language score was recentered at 1.5 *SD*s above and below the mean to test whether the intervention appeared to exert differential effects at these levels. When reanalyzing the data, the intervention group significantly outperformed the control group for expressive vocabulary at 1.5 *SD*s above the mean, $t(36) = 2.17$, $p = .037$. However, there was no significant difference between groups when analyzed at 1.5 *SD*s below the mean, $t(36) = 1.36$, $p = .16$. Thus, the treatment may have improved the expressive vocabulary skills of children who began the school year with higher language abilities relative to their peers, but it did not improve the expressive vocabulary of children with lower skill levels. Importantly, the treatment was not detrimental to children who entered the year with relatively lower language abilities. These results were unchanged when child age was added as a covariate, which therefore supports language ability, and not simply maturation, as the important moderator of intervention effects. In addition, treatment-by-age interaction models were not statistically significant.

Our final research aim addressed the relationship between teacher responsivity strategy use and children's language development. For this aim, we collapsed treatment and control teachers' use of communication-facilitating strategies, and as a result, we were no longer determining experimental effects of responsivity education but rather potential impacts of the active ingredients of the treatment on children's language outcomes, *as used by all teachers and not only those trained in their use*. While the use of communication-facilitating strategies was not significantly associated with gains in grammar ($B = –0.06$, $p = .72$), the strategies were significantly related to receptive and expressive vocabulary gains ($B = 3.95$, 1.85, respectively; $p = .013$, .014, respectively), even after applying the Benjamini–Hochberg correction. Thus, teachers' use of responsivity strategies was associated with children's vocabulary development regardless of whether teachers received training in the use of these strategies.

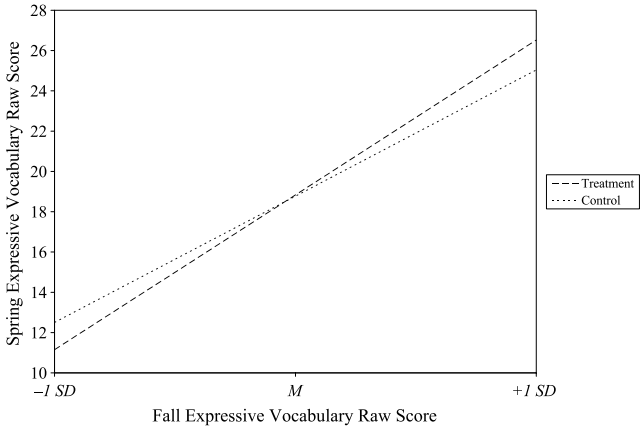
TABLE 6. HLM results for moderator analyses on oral language gains: Fall Language Score × Intervention Status interactions (γ_{11}).

Outcome variable	*N*	Coefficient	*SE*	*df*	*p*
Grammar	228	0.12	0.09	224	.18
Receptive vocabulary	240	0.09	0.07	236	.21
Expressive vocabulary	229	0.18	0.08	225	.02

Discussion

The purpose of this study was to examine the impact of teacher responsivity education on at-risk preschoolers'

FIGURE 1. Condition × Initial Language interaction for expressive vocabulary.



oral language and emergent literacy development. In this RCT, early childhood educators working in publicly funded programs (i.e., Head Start and state prekindergarten) were assigned to either a "business-as-usual" control condition or an intervention condition in which they were trained to use responsivity strategies designed to promote children's engagement and participation in extended conversations. This study used a rigorous methodological and analytic design, including a large number of teachers and children sampled from diverse locations, a professional development approach modified for potential scalability, and examination of both language and literacy outcomes. Although there were no main effects of the language intervention on children's oral language skills, there was a trend toward a positive effect on the expressive vocabulary development of children who began the year with relatively higher expressive language skills. In addition, we found nonexperimental effects indicating that all teachers' use of responsivity strategies was associated with gains in children's vocabulary skills. The intervention was also successful in enhancing preschoolers' emergent literacy skills in the area of print-concept knowledge. These findings are discussed in turn.

Main and Moderated Effects on Children's Oral Language Skills

Consistent with previous investigations of classroom-based language interventions (Coulter & Gallagher, 2001; Justice, Mashburn, Pence, & Wiggins, 2008), we found that the intervention did not exert a main impact on children's oral language skills, including grammar and vocabulary. While it may be the case that the intervention under study is simply not effective, there are several alternative reasons for this null finding. First, our outcomes represented distal measures of children's language ability, collected over a narrow time frame of approximately 6–8 months. Nuanced changes in children's language skills during this period may have been better captured using a highly proximal measure such as language samples, used in previous work on responsivity education (Girolametto et al., 2003). Second, our lack of main effects may have been due to control teachers' use of communication-facilitating responsivity strategies. Regardless of intervention condition, the relationship between the active ingredient of communication-facilitating strategies and children's language development over the year was positive and significant for vocabulary (both receptive and expressive skills), in keeping with previous reports (Girolametto & Weitzman, 2002; Justice, Mashburn, Pence, & Wiggins, 2008). A third reason that may explain a lack of main effects on children's language development is that teachers did not appear to frequently employ language-modeling strategies (see also Pence et al., 2008; Piasta et al., 2011). These strategies are designed to provide children with exposure to advanced language models from adults (e.g., stressing words to make them salient, expanding on what children say). It is important to note, however, that the vast majority of the research on the effect of language modeling is based on home or clinical settings focused on dyadic interactions, often with atypical populations. Thus, research has not yet delineated the extent to which teachers must employ these strategies to accelerate children's language skills.

The relationship between children's fall and spring language was evident in all analyses. That is, children's fall vocabulary and grammar consistently and positively predicted children's spring vocabulary and grammar. This finding points to the stability of children's language skills over time (i.e., rank order and spacing between children). Generally researchers have reported substantial year-to-year stability in children's grammar and vocabulary skills from the late preschool period forward into elementary school (NICHD, 2005; Storch & Whitehurst, 2002), with some research indicating that this stability begins earlier (Kendeou, van den Broek, White, & Lynch, 2009). Hart and Risley (1995), for instance, reported that children's vocabularies at age 3 predicted oral language performance at ages 9–10. Thus, although language skills grow over time, children's relative performance in relation to their peers likely stabilizes very early in development. This finding potentially informs the implementation of responsivity education interventions. Specifically, with regard to timing, this type of intervention may have its greatest impact if started earlier in children's language development, when language skills appear to be more malleable. In addition, providing responsivity education training to both teachers and parents across school and home contexts may provide children from low-SES backgrounds the consistent stimulation necessary to adequately boost language skills.

Although the intervention did not exert a main effect on children's language development, the present findings indicated a trend toward a moderating effect of initial child language. Children with relatively higher verbal ability at the start of the year made improvements under this enhanced language environment. Although this effect cannot be interpreted causally, this point is an important one, as the majority of this at-risk sample (65%) had initial language scores that were only at the 25th percentile, and the average initial language score for the entire sample was a standard score of approximately 84 (M = 100, SD = 15). Thus, the children who benefited most from this intervention did not exhibit unusually high language skills but rather were those in the high average range based on national norms.

It was not surprising that only some children seemed to benefit from the intervention, as the extant literature provides evidence and theory to support this finding. A similar trend has been reported in previous reports of language intervention (e.g., Justice et al., 2010; Mashburn et al., 2009; Penno et al., 2002; Yoder & Warren, 2002). It may be the case that children with better expressive language (i.e., expressive vocabulary) benefited most from such an intervention because verbal expression is the primary skill needed to engage in a conversation. As aforementioned, prior results have also demonstrated that the Learning Language and Loving It program produces positive expressive language results (Girolametto et al., 2003). We might presume that the children with greater verbal ability likely talked and initiated conversations more than other children and, in doing so, had more opportunities to practice and elicited increasingly advanced models of adult language input. Children's language level appears to affect teachers'

input (e.g., de Rivera, Girolametto, Greenberg, & Weitzman, 2005; Girolametto & Weitzman, 2002). In this way, children's active participation in conversations can catapult them to higher levels of success. Conversely, less conversationally skilled children more frequently experience highly directive and adult-dominated interactions (e.g., File, 1994; Pellegrino & Scopesi, 1990). These types of interactions tend to stifle child verbal productivity (e.g., Girolametto, Hoaken, et al., 2000; Girolametto & Weitzman, 2002), potentially increasing the gap between children with higher and lower expressive language skills.

Furthermore, observational research has shown that children with better language skills are more engaged during classroom activities and initiate more peer interactions; in contrast, children with language delays exhibit more disruptive behavior during structured classroom activities (Qi & Kaiser, 2004). Although teachers do not report differences between children with typical versus delayed language in terms of social skills and behavior, Qi and Kaiser's observational research shows that children do indeed *act* differently in the classroom based on their language abilities. Thus, the children in our study with higher verbal capabilities may have received a higher dose of the intervention not only because they had the ability to sustain the conversational exchanges with the teachers but also because they were more compliant students.

Main Effects on Children's Emergent Literacy Skills

The intervention exerted a main effect on children's emergent literacy development in the area of print-concept knowledge, or children's early understandings of how print works in a book. Since the intervention focused primarily on training teachers in conversational responsivity strategies, it is important to consider the mechanisms underlying the intervention's effect on children's print-concept knowledge. Accelerated development in this area may have been the result of (a) literacy components of the intervention or (b) an increase in teacher–child conversations surrounding print across classroom contexts.

First, the professional development offered to teachers included a short training about enhancing print awareness in the classroom, coupled with access to optional readings on this topic in the Learning Language and Loving It companion manual. Perhaps this minimal training served to increase focus on print, as prior research has shown that adults require little training to faithfully adopt print-related strategies (Ezell & Justice, 2000; Girolametto et al., 2007; Justice & Ezell, 2000). Of relevance to the current investigation, a previous study indicated that when teachers were provided brief training in print awareness, teachers readily increased their talk surrounding print (Girolametto et al., 2007).

There was also a monthlong focus on interactive storybook reading during the latter half of the intervention. The storybook-reading component emphasized engaging children in conversations by applying responsivity strategies within the context of book-reading sessions. Thus, teachers were instructed to respond to child initiations, expand on children's statements, ask open-ended questions, and extend ideas. Studies examining interactive reading of this nature (e.g., dialogic reading) have not only reported effects on children's language development (Whitehurst, Arnold, et al., 1994; Whitehurst et al., 1988; Whitehurst & Lonigan, 1998) but also potential effects on children's print-related skills, to include print-concept knowledge (Whitehurst, Epstein, et al., 1994; Whitehurst et al., 1999; see Reese & Cox, 1999). The interactive reading component may have provided a context for conversations that focused on print knowledge because storybook reading is an ideal time for teachers to engage children in talk about print concepts, print meaning, letters, and words. Indeed, meta-analyses have found modest to moderate associations of shared book reading on children's print-related emergent literacy skills (Bus, van IJzendoorn, & Pelligrini, 1995; Mol, Bus, & de Jong, 2009).

It may also be the case that across contexts, there were more conversations surrounding print in intervention classrooms than in control classrooms. Observational classroom data indicated that teachers had many displays of print in the classroom and provided children with frequent opportunities to write and look at storybooks on their own. In a print-rich environment, children would have many opportunities to attend to print and ask questions regarding literacy. Children from low-SES backgrounds appear to readily attend to print in their environments (Curenton & Justice, 2008), and children's questions are thought to be an important mechanism for development because they represent communicative attempts to gather information about the surrounding world (see Chouinard, 2007). As a result of the intervention, teachers were likely more attuned to children's interests and communicative attempts and therefore provided contingent responses to child initiations focused on print, leading to extended conversational exchanges surrounding print.

Limitations and Future Directions

Three salient limitations to present study warrant note. First, our present findings are limited in that intervention teachers' uptake of the responsivity strategies was variable and not fully differentiated across the treatment and comparison conditions in one set of strategies (i.e., language-modeling strategies; Girolametto et al., 2003; Piasta et al., 2011). Teachers' implementation and treatment-comparison group differentiation may have been increased if a more rigorous approach to professional development was used. It is important for the reader to note that we do not conclude from our lack of main effects on child language that this reduced intensity version of the curricular supplement Learning Language and Loving It is ineffective in promoting children's language development, but rather it raises questions as to the effectiveness of reduced intensity training and distance coaching in this particular approach to professional development (for further discussion, see Piasta et al., 2011). There is a great need for future research that identifies effective and efficient ways to promote teachers' conversational responsivity in the preschool classroom, particularly ways that are scalable. In addition, research is needed to unpack the benefit versus the cost of this and similar interventions.

Second, study procedures did not lend themselves to the examination of dialectical differences among teachers and children. Dialect may be an important contributor to children's responsiveness to language-oriented interventions, and individual differences among children with respect to dialect should be an important focus in future research.

Third, the present study did not address the intervention's impact on child social skills or peer interactions, which are important considerations (Girolametto et al., 2006; Girolametto, Weitzman, & Greenberg, 2004). Understanding the link between social skills and language is noteworthy when evaluating a classroom-based intervention focused on extending teacher–child conversations because social skills play as essential a role in conversations as language skills. Coulter and Gallagher (2001) reported that teacher responsivity education appeared to have an impact on children's social skills. Likewise, peer interaction likely exerts an influence on language development (Girolametto & Weitzman, 2007). A recent report found that the language development of preschool children is positively associated with the expressive language abilities of their peers (Mashburn et al., 2009). Future studies of classroom-based language interventions should specifically examine peer-to-peer interactions as well as social skills development.

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