



Impact of professional development on preschool teachers' conversational responsivity and children's linguistic productivity and complexity

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ABSTRACT

The present study investigated the effect of professional development (PD) on preschool teachers' conversational responsivity in the classroom, defined as teachers' use of strategies to promote children's participation in extended conversational exchanges (communication-facilitating strategies) and exposure to advanced linguistic models (language-developing strategies), and the resultant impact on proximal child language outcomes. We randomly-assigned 49 preschool teachers to receive 15–20 h of such PD (PD; $n=25$) or to a comparison condition ($n=24$). Growth curve analysis indicated that trained teachers used significantly more communication-facilitating strategies across the year but no such difference for language-developing strategies. Moreover, children in these classrooms showed greater linguistic productivity and complexity in their talk. These findings suggest that PD may alter some aspects of teachers' conversational responsivity responsible for increasing the amount and complexity of child language. Alteration of some strategies, however, may require more intensive PD efforts.

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Given the current emphasis on promoting young children's school readiness within federal, state, and local educational policies, considerable attention is focused on identifying effective classroom strategies for developing children's academic, socio-emotional, and behavioral skills during the preschool years (e.g., National Early Literacy Panel, 2008; National Research Council, 2001; Preschool Curriculum Evaluation Research Consortium, 2008). This attention has largely focused on how access to high-quality preschool may mitigate the developmental and achievement gaps apparent between children from more and less advantaged backgrounds (e.g., Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001; Justice, Mashburn, Hamre, & Pianta, 2008; La Paro, Pianta, & Stuhlman, 2004; Mashburn et al., 2008; Peisner-Feinberg & Burchinal, 1997; Zill & Resnick, 2006). Children from economically-disadvantaged backgrounds are especially likely to show lags in language and communication skills, including vocabulary, morphology/syntax, and discourse (e.g., Bowey,

1995; Dickinson & Snow, 1987; Hoff-Ginsberg, 1998; Justice & Ezell, 2001), which, in turn, are associated with increased risk for later difficulties in academic and social/relational skills (e.g., Catts, Fey, Zhang, & Tomblin, 1999; Fujiki, Brinton, & Clarke, 2002). Correspondingly, national and state standards for learning consistently emphasize language as an important domain for preschool educators to target in their classrooms (Florida Department of Education, 2008; National Association for the Education of Young Children, 1998; Ohio Department of Education, 2007).

The present study is directly relevant to such initiatives, namely by examining how language-learning opportunities might be improved within preschool classrooms enrolling children from economically-disadvantaged homes. Specifically, this research examined the effectiveness of professional development (PD) emphasizing conversational responsiveness, or "responsivity education" (Fey et al., 2006). Drawing on a large body of research involving both teachers (e.g., Girolametto & Weitzman, 2002; Girolametto, Weitzman, & Greenberg, 2003; Pence, Justice, & Wiggins, 2008; Weitzman, 1994) and other caregivers (e.g., Fey et al., 2006; Girolametto, 1988a; Landry, Smith, & Swank, 2006; Tannock, Girolametto, & Siegel, 1992; Yoder & Warren, 2002), 25 preschool teachers were taught to use specific responsivity strategies within the ongoing social exchanges of the classroom environment. We sought to determine whether participation in such PD would increase teachers' use of these strategies over time,

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differentiating between communication-facilitating strategies and language-developing strategies. Additionally, we also sought to determine if the conversational productivity and complexity of children enrolled in these classrooms would be positively affected.

1. Preschools as language-learning environments

Both theory (e.g., Bruner, 1975, 1981; Chapman, 2000) and recent research (e.g., Zimmerman et al., 2009) suggest that children's language development is contingent upon the quality and quantity of language and communicative acts to which they are exposed. Considerable evidence supports a direct correspondence between classroom language environments provided in preschool and children's language productivity (e.g., Girolametto & Weitzman, 2002; Girolametto et al., 2003) and growth (e.g., Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002; Justice, Mashburn, Pence, & Wiggins, 2008; Logan, Piasta, Justice, Schatschneider, & Petrill, 2011; Mashburn et al., 2008). High-quality language interactions during preschool may be particularly important for children at risk for language difficulties, including those from disadvantaged backgrounds (Justice, Mashburn, Hamre, et al., 2008). Some study findings suggest that high-quality experiences may mitigate language risks faced by these children (Hubbs-Tait et al., 2002; Logan et al., 2011; Tabors, Snow, & Dickinson, 2001).

The language-learning environments provided within early childhood settings have often been characterized as being of relatively low quality, and this is particularly the case for children from economically-disadvantaged backgrounds (Justice, Mashburn, Hamre, et al., 2008; La Paro et al., 2004; LoCasale-Crouch et al., 2007; Mashburn et al., 2008). Justice, Mashburn, Hamre, et al. (2008), for instance, found that the quality of the language-learning environment in 135 preschool classrooms serving low-income pupils was highly and positively skewed when assessed with the Classroom Assessment Scoring System (Pianta, La Paro, & Hamre, 2006): The majority (54%) of classrooms received the lowest ratings (1s or 2s) on the measure's 7-point scale, with only 4% receiving high-quality ratings (6s or 7s). As a result, researchers have emphasized the importance of conducting rigorous tests of PD with respect to its potential for increasing early childhood teachers' provision of high-quality language experiences (Dickinson, Darrow, & Tinubu, 2008; Girolametto & Weitzman, 2007; Justice, Mashburn, Hamre, et al., 2008).

One potential means of improving the preschool classroom language-learning environment involves supporting teachers in being more conversationally responsive to children. Conversational responsiveness is defined as "the ability to respond verbally or non-verbally to a communication partner and maintain topics for successive turns" (Bonifacio et al., 2007, p. 608). Conversationally-responsive adults encourage children's active and continued participation in discourse by displaying emotional warmth (e.g., positive tone of voice, appropriate pace) and using a variety of techniques to engage and support children's language interactions (Fey et al., 2006; Landry, Smith, Miller-Loncar, & Swank, 1997). Such techniques generally fall into two main categories: communication-facilitating strategies to promote children's participation in conversations (e.g., using a slow pace to encourage children to talk, using open-ended questions to cue child responses) and language-developing strategies to provide advanced language models to children during conversations (e.g., providing recasts, expansions, and models of diverse vocabulary; see Girolametto & Weitzman, 2006). Studies indicate that adult responsiveness has a variety of positive outcomes for children, including increased communicative attempts, enhanced joint engagement, and greater language use, diversity, and

complexity (Baumwell, Tamis-LeMonda, & Bornstein, 1997; Landry et al., 1997; Landry, Smith, Swank, & Guttentag, 2008; Tamis-LeMonda, Bornstein, & Baumwell, 2001; Tomasello, 2005). Notably, these relations appear to be causal (Girolametto, 1988b; Girolametto, Pearce, & Weitzman, 1996; Girolametto, Verbey, & Tannock, 1994; Landry, Smith, et al., 2006).

Findings such as these have led researchers to consider the potential benefits of PD for enriching the preschool classroom language-learning environment. For example, Wasik, Bond, and Hindman (2006) conducted a randomized controlled trial in which Head Start teachers in the experimental condition received over 18 h of PD aimed at improving children's language and literacy skills. Some of this PD focused on conversational responsiveness and increasing teachers' use of communication-facilitating and language-developing strategies; for instance, one focus of in-service trainings and biweekly classroom visits was to help teachers learn to actively listen to children, model and use new vocabulary, ask questions, and provide feedback during shared reading and other classroom activities. Despite a great deal of within-group variability, results showed significant overall gains in teacher-child verbal exchanges for teachers who received PD as opposed to those who did not. Other studies have also reported successful results for using PD to improve the preschool language-learning environment, although such studies typically seek to improve the general quality of teacher-child conversations rather than responsiveness exclusively (Dickinson & Caswell, 2007; Jackson et al., 2006; Landry, Swank, Smith, Assel, & Gunnewig, 2006; Pianta, Mashburn, Downer, Hamre, & Justice, 2008; Scanlon, Gelzheiser, Vellutino, Schatschneider, & Sweeney, 2008).

In fact, few studies have focused specifically on providing conversational responsiveness PD to teachers, with work by Justice and colleagues and Girolametto and colleagues as notable exceptions. Justice and colleagues (Pence et al., 2008) used a randomized controlled trial to evaluate the impact of PD on preschool teachers' use of specific language-facilitating strategies (e.g., recasts, expansions, and redirects) as part of the implementation of a general language-focused curriculum. Language-facilitating strategy use was considered an "active ingredient" of this curriculum, and teachers participated in a 3-day workshop to learn these strategies (see Pence et al. for a more thorough description). In general, teachers' uptake of the language-facilitating strategies was very low, especially when assessed immediately following the initial PD workshop; at this first observation, teachers' strategy use was not statistically different than "business-as-usual" controls. Nonetheless, as the year progressed, teachers systematically increased their strategy use, evidenced by large fall to spring effect sizes. Study findings further showed a significant interaction between the extent to which teachers used the active ingredients (the language-facilitating strategies), the extent to which children were present over the academic year, and children's language growth over time (Justice, Mashburn, Pence, et al., 2008).

Girolametto et al. (2003) found similar results when conducting a randomized controlled trial of an extensive conversational responsiveness PD series for early childhood educators. Teachers showed a significant increase in use of only two of the five communication-facilitating strategies trained after 14 weeks of small group and individual PD; findings for language-developing strategies were not reported. In a related study, the same authors reported that children's language productivity (i.e., production of more utterances and words) and complexity (i.e., production of more grammatically complex utterances) was closely related to the extent to which their teachers used these strategies (Girolametto & Weitzman, 2002). The findings from this body of work suggest that: (a) early childhood teachers' "uptake" of PD may vary across different types of strategies, (b) teachers may show a very gradual increase in their uptake of strategies over time, and (c)

the frequency with which teachers use such strategies appears to be associated with children's proximal and distal language development (see Cabell et al., 2011; Girolametto & Weitzman, 2002; Justice, Mashburn, Pence et al., 2008).

2. Conversational-responsiveness: the Learning Language and Loving It approach

Given the potential value of adults' use of responsivity strategies when interacting with children, there have been a number of efforts to develop means for effectively promoting adults' use of such strategies. Such efforts transcend both parents (e.g., Fey et al., 2006) and teachers, for whom the most well-known is perhaps the Hanen Center's *Learning Language and Loving It—The Hanen Program for Early Childhood Educators* (LLI; Weitzman, 1994; Weitzman & Greenberg, 2002). LLI is theoretically situated in the literature on parent-child responsivity (Girolametto & Weitzman, 2002; Weitzman, 1994) but is oriented specifically to early childhood educators, with materials carefully crafted to speak to this audience.

As a PD program, LLI reflects generally recommended practices for influencing teachers' classroom behaviors (Dickinson et al., 2008; Guskey, 2003; Wasik & Bond, 2001; West-Burnham & O'Sullivan, 1998). LLI training provides participating educators with a rationale supporting the relevance and importance of new or modified practices, opportunities for practice and self-reflection, and coaching and feedback over the course of an intensive 20-h workshop featuring regularly-scheduled small group evening meetings ($n = 8$) and biweekly on-site coaching with certified speech-language pathologists serving as LLI facilitators (Girolametto et al., 2003). The coaching component of LLI, in particular, is aligned with recent research highlighting its effectiveness in improving the instruction provided by early childhood educators (Landry, Anthony, Swank, & Monseque-Bailey, 2009; Neuman & Cunningham, 2009; cf. Assel, Landry, Swank, & Gunnewig, 2007; Lonigan, Farver, Phillips, & Clancy-Menchetti, 2011).

Several studies have examined whether LLI training positively affects various teachers' use of communication-facilitating and language-developing responsivity strategies and child language outcomes when delivered intensively to small groups of early childhood educators (Flowers, Girolametto, Weitzman, & Greenberg, 2007; Girolametto et al., 2003; Girolametto, Weitzman, & Greenberg, 2004; Girolametto, Weitzman, Lefebvre, & Greenberg, 2007). In these studies, Canadian day-care providers and preschool teachers who completed the extensive LLI training tended to exhibit features of higher quality caregiver-child interactions than those assigned to control conditions with some impact on the language productivity of children, all of whom exhibited "age-appropriate" language skills. However, educators typically did not show improvements in all responsivity strategies trained (Girolametto et al., 2003). Generally, these results speak to the potential of LLI in altering aspects of early childhood educators' conversational responsivity to create richer classroom language-learning environments, but suggest that further research delineating effects is needed.

These promising prior reports also raise questions as to the generalizability of findings to the large, publicly-funded preschool programs common in the United States. Programs such as Head Start and state targeted-enrollment preschool are designed to support sizeable numbers of children from disadvantaged homes, many of whom exhibit considerable risk factors including low language skills. Given the scale of such programs, it is important to consider whether LLI, and PD aimed at increasing conversational responsivity more generally, can achieve positive impacts on teachers and children when implemented with some reductions to PD. Whereas prior studies of LLI have involved relatively small, homogenous teacher samples and provision of high-intensity PD

involving a 14-week teacher commitment, the publicly-funded programs in the US may not be able to support PD of this scope and duration; thus, it is relevant to consider whether a reduced version of PD could achieve impacts similar to that reported in the literature.

3. The present study

The present work was conducted to determine whether an adapted version of the LLI program, as a well-established and manualized form of PD for early childhood educators, can promote the conversational responsivity of preschool educators working with children at risk for developmental and academic difficulties. We also determined whether teachers' participation in PD had positive impacts on the linguistic productivity and complexity of children in their classrooms, based on analysis of characteristics of children's talk within small-group interactions. This study involved a randomized controlled trial (RCT) with 49 preschool teachers employed in a variety of targeted-enrollment preschool settings and a randomly selected subsample of 330 children (mean age 52 months, all low-socioeconomic status) from their classrooms. The PD delivered to teachers used the materials of the LLI program designed by the Hanen Center but the approach was adapted for use at larger scale. These adaptations included: (a) providing PD to teachers in an intensive 3-day summer institute (e.g., Justice, Mashburn, Pence et al., 2008; Landry, Swank, et al., 2006), as opposed to biweekly group meetings conducted over a 14-week period, and (b) providing written feedback to teachers based on twice-monthly classroom videotapes that they submitted to research staff, as opposed to multiple, in-class visits and on-site coaching. The latter is supported by recent findings supporting the use of remote coaching and consultation as an alternative means of providing individualized feedback to teachers (e.g., Downer, Kraft-Sayre, & Pianta, 2009; Downer, Locasale-Crouch, Hamre, & Pianta, 2009; Pianta et al., 2008; Powell, Diamond, Burchinal, & Koehler, 2010). Such adaptations afforded implementation of PD on a wider scale, in geographically-dispersed locations, and with more feasible preschool center and teacher resources and commitments (financial, time, and so forth).

The present work is best considered in conjunction with our recent study describing impacts of teachers' participation in this PD on the language and literacy gains of children (Cabell et al., 2011). Cabell et al.'s study showed (a) that children whose teachers received PD had greater gains in print-concept knowledge over the academic year compared to children in comparison classrooms, (b) moderated effects of the PD on children's language skills similar to those reported by Yoder and Warren (2002), such that children who began with relatively high language skills appeared to benefit from being in classrooms with teachers who experienced PD but those who began with relatively low language skills did not, and (c) a positive association between teachers' overall use of communication-facilitating strategies (averaged over the fall, winter, and spring observations) and children's vocabulary development irrespective of condition. It is important to note that Cabell et al. investigated PD impacts only on distal, standardized language measures whereas prior research concerning conversational responsivity as implemented by parents (Fey et al., 2006; Girolametto et al., 1996) or early childhood educators (Girolametto et al., 2003) have generally investigated impacts on proximal measures of children's linguistic productivity and/or complexity via coded language samples.

The findings presented in Cabell et al. (2011) suggest that teachers' use of responsivity strategies may be a key "active ingredient" of this PD and the language-learning environments of preschool classrooms more generally. Thus, in this study, we sought to more fully explore the extent to which teachers who

received PD modified their use of these strategies in the short- and long-term in relation to comparison teachers. This is the first study of which we are aware to use growth-curve analysis to model preschool teachers' use of language-related strategies across an academic year. At the same time, given the Cabell et al. results in which treatment impacts on more distal measures of language skill were not apparent except in relation to questions of moderation, this study mirrored the larger literature in examining PD impacts on proximal measures of children's language skills that would seem to be most directly affected by teachers' implementation of responsivity strategies; we documented children's linguistic productivity and complexity when interacting with their teachers during small-group, play-based interactions.

To sum, this study addressed two primary aims. The first aim was to investigate the extent to which preschool teachers' participation in PD influenced their immediate and sustained use of communication-facilitating and language-developing strategies over the academic year. In addressing this aim, we also explored whether specific characteristics of teachers, such as their beliefs, experience, and educational background, predicted their use of communication-facilitating and language-developing strategies. The second aim was to investigate whether the conversational productivity and complexity of children in PD classrooms was increased as compared to children in comparison classrooms.

4. Method

4.1. Participants

Two sequential cohorts involving a total of 49 preschool teachers from a single mid-Atlantic state participated in the study and were randomly assigned to PD treatment ($n=25$) or comparison conditions ($n=24$). All teachers were volunteers and were recruited through contacts with preschool administrators and information sessions. Participating teachers taught in 38 different preschool programs, with 19 programs involved in each study condition. All were targeted enrollment programs, in that only children exhibiting risk were eligible for participation. Risk was largely based on household income to prioritize enrollment for children residing in poverty. Thirty-seven teachers taught in Head Start programs, and twelve taught in programs supported by a state pre-kindergarten initiative. Although some classrooms within these programs had multiple lead teachers, only one teacher per classroom was randomly selected to participate in the study for purposes of data collection.

The majority of teachers were female (96%; two males). Sixty-seven percent of teachers were Caucasian, 22% were Black, 2% were Native American, and 4% were multiracial (two teachers did not report demographic information). Most teachers had earned college degrees (37% Associate's, 33% Bachelor's, 22% Master's), although 4% held only a high school diploma (4% unreported). Teachers reported an average of 11.8 years ($SD=7.4$) of teaching experience, mainly in preschool classrooms ($M=9.47$ years, $SD=6.70$). Descriptive statistics for these indices across PD treatment and comparison teachers are provided in Tables 1 and 2. All but five teachers reported having an aide for at least half of the school day. Classroom sizes ranged from 16 to 20 children ($M=17.59$; information collected for cohort 2 only).

Data were collected for a random sample of students ($n=330$, 174 males and 156 females) selected from each teacher's classroom; these children were assessed on direct measures in the fall and spring of the academic year to study project impacts. Given the use of random sampling, information about these 330 students can be used to make generalizations about the larger population of ~860 children in the 49 classrooms. The random samples of

Table 1

Gender, race/ethnicity, level of education, and program type for teachers participating in treatment and comparison conditions.

Variable	Treatment		Comparison	
	<i>n</i>	%	<i>n</i>	%
Female	23	92	24	100
Race/ethnicity				
White/Caucasian	16	64	17	71
Black/African-American	7	28	4	17
Native American/Indian			1	4
Multi-racial	1	4	1	4
Unreported	1	4	1	4
Highest degree attained				
High school	1	4	1	4
Associates degree	8	32	10	42
Bachelors degree	11	52	5	21
Masters degree	4	16	7	29
Unreported	1	4	1	4
Program type				
Head Start	19	76	18	75
State preK initiative	6	24	6	25

Note. The treatment condition had an overall sample size of 25 teachers. The comparison condition had an overall sample size of 24 teachers.

children were between 40 and 60 months of age ($M=52$ months, $SD=5.5$) in the fall of the year. Children were 45% Caucasian, 33% African American, and 5% Hispanic/Latino (16% were multiracial, other, or unreported). The majority of children (56%) lived in households with an annual income of less than \$25,000 (55.5%); 16% lived in households earning between \$25,000 and \$50,000, and 7% lived in households earning greater than \$50,000. Results of direct assessments conducted in the fall of the academic year using two standardized measures of language ability showed that children's language skills were lower than expected based on normative references. Specifically, the mean standard score for the Core Language Composite of the *Clinical Evaluation of Language Fundamentals Preschool-2* (CELF-P:2; Wiig, Secord, & Semel, 2004) was 84 ($SD=18$) and the mean standard score for the *Peabody Picture Vocabulary Test-III* (PPVT III; Dunn & Dunn, 1997) was 87 ($SD=18$). About 50% and 43% of children had scores ≤ 1 SD below the mean on the CELF-P:2 and PPVT III, respectively.

The majority of teachers ($n=43$) reported using *The Creative Curriculum for Preschool* (Dodge, Colker, & Heroman, 2002) as the main classroom curriculum; three treatment teachers used *High/Scope* (Hohman & Wikhart, 1995), and one treatment teacher reported using both curricula simultaneously (unreported for two teachers). These curricula provide a general codified framework for the preschool classroom, with an emphasis on the physical classroom environment, structured routines, classroom community, and objectives for academic content. Teachers' use of responsivity strategies, as taught within the PD program provided to treatment teachers, could easily be integrated within the framework of either of these curricula. It is likely that small group activities were generally a routine part of daily practice. Specifically, teachers were surveyed regarding the extent to which they worked with small groups on a 4-point scale: (1) never, (2) a little, (3) some, and (4) usually. The majority of teachers reported that they worked some or usually with "small groups of students who are at about the same skill level" (78.5%) and "small groups of students who have similar interests" (92.9%; seven unreported).

4.2. Procedure

The experimental manipulation in the study concerned the PD that teachers received. PD status (treatment versus comparison) was established via random assignment. Random assignment was blocked by center due to the fact that a few centers ($n=5$) had

Table 2
Teaching experience, self-efficacy, and beliefs about children descriptive statistics for teachers participating in treatment and comparison conditions.

	Treatment			Comparison		
	<i>M</i>	SD	Range	<i>M</i>	SD	Range
Years of teaching experience						
Preschool	10.04	7.72	0–23	9.43	5.60	0–19
Overall	12.79	8.23	0–27	10.74	6.38	0–25
Self-efficacy	3.60	0.54	2.45–4.65	3.60	0.47	2.45–4.35
Beliefs about children	2.31	0.53	1.44–3.25	2.34	0.47	1.06–3.00

Note. The treatment condition had an overall sample size of 25 teachers. The comparison condition had an overall sample size of 24 teachers.

multiple participating teachers; teachers employed at the same preschool centers were assigned to the same condition in order to prevent treatment diffusion.

4.2.1. Treatment condition

Teachers in the treatment condition received PD focused on increasing their conversational responsivity in the classroom. As adapted from LLI (Weitzman, 1994; Weitzman & Greenberg, 2002), the PD approach was framed around training educators to use a set of responsivity strategies for stimulating teacher–child interactions. Training occurred in the form of an intensive group workshop prior to the academic year coupled with individual teacher feedback provided in written format during the academic year. Teachers also received a comprehensive manual outlining the strategies (Weitzman & Greenberg, 2002).

Workshops were conducted by two research staff, at least one of whom was certified by the Hanen Center in LLI, who presented content developed by the Hanen Center and based on the LLI training manual (Greenberg, 2004). The training consisted of eight distinct sessions that focused on strategies that set up and promoted extended conversational exchanges with children (i.e., communication-facilitating strategies) as well as ways to enrich children's language within conversational exchanges by providing advanced language models (i.e., language-developing strategies). In August, treatment teachers attended a 3-day training institute (approximately 13 h of PD in total). The institute included an overview of responsivity as well as training in specific LLI content and strategies. In January, teachers attended a 1-day in-service workshop (4 h) during which initial material was reviewed and additional content and strategies were presented. All training sessions included PowerPoint presentations, video demonstration of strategy use within preschool classrooms, and teacher role-play of strategy use. Relevant to the present study, teachers specifically practiced a variety of strategies within a small group play-doh setting. However, teachers were encouraged to use strategies throughout the school day during a range of contexts, to include one-on-one, shared storybook reading, and large-group settings. Throughout the academic year, teachers were asked to read sections from the provided manual and reflect on their use of responsivity strategies within the classroom.

Teachers were also provided with and trained to use digital camcorders to record their classroom instruction. Every 2 weeks, teachers submitted a 20-min videotape of classroom teacher–child interactions and were instructed to capture interactions with a random sampling of children from their classrooms. Videos followed a standardized recording schedule indicating the range of dates during which they were to be conducted and the type of classroom activity that was to be recorded (e.g., play-doh activity, any small group activity, storybook reading session). Teachers were provided with materials necessary to execute these activities (e.g., play-doh). The schedule also indicated specific responsivity strategies serving as foci for each video (e.g., follow the child's lead), with communication-facilitating strategies preceding language-developing strategies. Teachers were assigned to a trained research

staff member who served as a consultant, providing individual coaching (all in written feedback letters) on their implementation of the responsivity strategies throughout the year, based on viewing the submitted videotapes. Teachers were asked to develop an action plan for interactions prior to the activity and view the video after the activity; they prepared a brief written reflection providing examples of responsivity strategy use as well as missed opportunities. Typically prior to the next recording session, feedback was provided via and included: (1) acknowledgment of those responsivity strategies the teacher used consistently and correctly within the classroom, (2) reminders and tips on using additional responsivity strategies in the future, and (3) identification of practices in conflict with the responsivity approach and suggestions for replacement strategies. Feedback was approximately one to two pages in length and generally focused on the specified target of the video and/or the specific needs of individual teachers. Whenever possible, consultants integrated specific examples from the observed interactions, highlighting high-quality strategy use (e.g., *when you responded to Todd's comment about his new shoes, you expanded with an open question, "What do you like best about your new shoes?" In turn, this encouraged Todd to continue the conversation with you.*) And offering specific suggestions to improve strategy use (e.g., *you do a good job of repeating what children are saying. Now take this a step further and expand by adding an idea. Tamika said, "I'm cutting." You could have expanded her comment by saying, "You are cutting the play-doh with your knife."*). Teachers were provided with the opportunity to converse with their consultant via but they did so infrequently.

4.2.2. Comparison condition

Teachers assigned to the comparison condition received an equivalent amount of PD, albeit on topics unrelated to conversational responsiveness. Topics included behavior management, storybook selection, math instruction, and adapting the classroom for children with special needs. Teachers in this condition received approximately 13 h of training at an August institute and 4 h of training during an in-service workshop in January. These teachers also received and were trained to use digital camcorders to record biweekly 30-min videos of classroom instruction. The video recording schedule was the same as that provided to the treatment teachers, with the exception that the responsivity strategies and manual were not referenced. Comparison teachers also received the same materials as the treatment teachers (e.g., play-doh) necessary to execute the activities to be videotaped. Thus, the same types of activities were captured by the comparison teachers (e.g., play-doh setting) without the responsivity focus. Comparison teachers were assigned consultants who either provided generic feedback regarding best practices or simply acknowledged receipt of the video. These teachers were also provided the opportunity to interact with consultants via

4.3. Measures

Two primary sets of measures were utilized in the current study: (a) assessments of teachers' use of responsivity strategies across

the academic year and information derived from the fall teacher questionnaires, and (b) assessments of children's linguistic productivity and complexity during small-group interactions with their teachers.

4.3.1. Teachers' responsivity strategy use

To assess teachers' conversational responsivity over the academic year, three of the teacher-submitted videos were coded for each teacher in the treatment and comparison conditions. The three videos corresponded to those taken at the beginning (week 2, October), middle (week 14, January), and end (week 24, April) of the project. Three teachers failed to submit videos for week 24; consequently, videos recorded from the previous 2-week cycle (week 22) were coded for these teachers.

Previous studies have typically documented teachers' use of responsivity strategies based on coding brief but continuously sustained interactions between teachers and their students (e.g., Girolametto et al., 2003). In the present study, a 7.5-min continuous segment from each submitted video was scored using the Conversational Responsiveness Assessment and Fidelity Tool (CRAFT; Friel, Wiggins, & Justice, 2007). During these videos, teachers were engaged in a small-group, play-based activity with their students; specifically, teachers were asked to engage in a play-doh activity with six or fewer children. This setting is largely child-directed and typically promotes a greater use of conversationally responsive strategies among untrained teachers than does large-group or teacher-directed settings (Girolametto & Weitzman, 2002; Pence Turnbull, Anthony, Justice, & Bowles, 2009). Thus, this setting provides an ideal opportunity to evaluate change in teachers' use of responsivity strategies. Assessment of the actual number of children teachers included in their videotaped small-group interactions (based on coding of 36 of the 49 fall videos) indicated that the interactions involved an average of 5 children, with 90% involving between 3 and 7 children.

Items included in the CRAFT were drawn from careful analysis of the LLI materials, to include both the implementation manual and the PD fidelity of implementation tool, the 11-item Teacher Interaction and Language Rating Scale (TILRS; Girolametto, Weitzman, & Greenberg, 2000). The CRAFT included a total of 18 specific items coded using a time-sampling technique. The full measure is available upon request from the first authors.

Our interest here is assessment of teachers' use of two sets of responsivity strategies coded on the CRAFT. *Communication-facilitating strategies* included five strategies that teachers use to encourage and maintain classroom conversations: (1) welcoming interaction opportunities via looking expectantly and being warm and receptive; (2) allowing children to participate more easily by using a slow pace of conversation; (3) using comments to cue additional turn-taking; (4) using questions to stimulate conversation; and (5) facilitating peer-to-peer communication. *Language-developing strategies* included four strategies that teachers use to teach children new language forms or functions: (1) making words more salient using stress and/or repetition; (2) recasting and expanding children's utterances; (3) generally providing additional information about objects or topics; and (4) providing opportunities to talk about feelings, to project or pretend, or to talk about the past or future. Each of these nine strategies represented a distinct item on the CRAFT coding scheme.

For the purposes of coding, videos were divided into fifteen 30-s cycles and coded cycle by cycle. Within each 30-s cycle, an observer scored each of the CRAFT strategies for presence (1) or absence (0). Thus, multiple CRAFT items could be scored simultaneously such that in any given 30-s cycle, a teacher could be scored for using up to all nine strategies. The total score for each strategy was averaged across cycles, to account for cycles that were uncodable (e.g., due to poor video quality). Average item scores were

then summed to create composites for each of communication-facilitating and language-developing strategies.

CRAFT coding was conducted by research staff who were initially trained to 90% accuracy on three master-coded video segments. Double-coding of a random sample of 10% of videos showed continued high reliability, with 86% and 88% exact agreement among coders across the five communication-facilitating and four language-developing strategies, respectively.

4.3.2. Additional teacher information

Information concerning teachers' levels of education and total years of teaching experience was recorded from a questionnaire completed at fall PD workshops. In addition, teachers' self-reported sense of self-efficacy and beliefs about children were recorded using two scales. Two teachers failed to complete any questionnaires; thus, full data were available for 47 teachers with respect to education level, teaching experience, and beliefs about children. Two additional teachers did not complete the self-efficacy scale ($n=45$).

Teachers' self-efficacy was assessed with a 20-item survey used in the NICHD Study of Early Childcare and Youth Development and adapted from Bandura (1993). Self-efficacy in areas such as discipline (e.g., how much can you do to prevent problem behavior?), instruction (e.g., how much can you do to increase students' memories of what they have learned?), positive environment (e.g., how much can you do to make students enjoy coming to school?), and school/classroom decision-making (e.g., how much can you influence the decisions that are made in your school?) was assessed. Teachers responded using a 5-point Likert-scale, ranging from 1 (no feelings of efficacy) to 5 (very strong feelings of efficacy). Responses showed high internal consistency (Cronbach's $\alpha=0.91$) and were averaged to create a composite, with higher composite scores reflecting greater feelings of self-efficacy.

Teachers' beliefs about children were assessed with the 16-item Modernity Scale used in Justice, Mashburn, Hamre, et al. (2008) and adapted from the Ideas about Raising Children Scale (Schaefer & Edgerton, 1985). The scale discriminates teachers with generally traditional or adult-centered perspectives on interactions with children and those with modern or progressive child-centered perspectives. Teachers were asked to rate their agreement with statements such as "Children learn best by doing things themselves rather than listening to others" and "Children should be kept busy with work and study at home and at school" using a 5-point Likert-scale (1 = strongly disagree to 5 = strongly agree). Responses were averaged after reverse-coding child-centered items to create composite scores (Cronbach's $\alpha=0.70$), with higher scores indicating more adult-centered perspectives.

4.3.3. Children's linguistic productivity and complexity

For the purpose of this study, the videos submitted by teachers at the beginning (week 2) and end (week 24 or week 22) of the project, representing the fall and spring of the academic year, were also transcribed verbatim using the Systematic Analysis of Language Transcripts software for Windows (SALT). These videos depicted teachers interacting with a small group of children.

Transcription was conducted word-for-word with parsing at the level of the T-unit; a T-unit comprises an independent clause with all dependent clauses and phrases. Transcription involved demarcating two speakers: Teacher (T) and Child (C), such that all child utterances were aggregated as one speaker. Transcription was conducted by staff who had completed a comprehensive training program involving (a) multiple training and practice sessions in which language samples were transcribed and then compared word-for-word against gold-standard codes and (b) one (or more, if needed) reliability tests in which individuals needed to achieve 90% or better word-for-word transcription on four consecutive

language samples. All transcripts were checked for accuracy by an independent and reliable transcriber after initial transcription.

When all transcription was completed, the SALT software was used to automatically generate two measures of children's linguistic productivity during the interaction: (1) total number of utterances (Total Utterances) which comprised the total number of T-units produced during the entire interaction, and (2) total number of different words (NDW) which was the total number of different word roots produced. The software also generated a measure of linguistic complexity (mean length of utterance, MLU) which was the average length, in morphemes, of children's T-units. It is important to note that these linguistic indices represent the talk of all children, in the aggregate, within a small group interacting with their teacher; this analytical approach has been used in prior studies of conversational responsivity (see Girolametto et al., 2003), but the limitations of extrapolating findings for these aggregated data to the language skills of individual children should be recognized.

4.4. Individual growth curve analysis of teacher data

Given interest in both the extent of teachers' responsivity strategy use as well as changes in responsivity strategy use across the academic year, individual growth curve analysis was used to analyze the teacher data. Growth curve analysis confers a number of benefits over traditional analysis of variance or multiple regression approaches to analyzing repeated-measures (see Francis, Schatschneider, & Carlson, 2000 for a review). Of relevance to the present study, growth curves allow for (a) consideration of all data points (three in the current study) to represent individual's change over time as a function of both intercept (i.e., level of a trait at any given time) and slope (i.e., rate of change over time), (b) estimation of these parameters even when assessment points differ across participants, and (c) examination of both intra- and inter-individual differences in change over time, including examination of group or mean differences as correlates of change. Growth curves thus allowed us to describe change in teachers' responsivity strategy use across the academic year and also investigate such change as a function of the study condition to which teachers were assigned. Note that analyses did not nest teachers within centers because this was redundant information for the vast majority of teachers, given the small number of centers contributing multiple participating teachers. Preliminary analyses in which center-level variance were investigated supported this decision.

Growth curve analyses were conducted using hierarchical linear modeling (HLM; Raudenbush & Bryk, 2002) for each of the two CRAFT composite scores. Time was measured in weeks. As recommended (Francis et al., 2000; Hox, 2002), analyses consisted of two phases: a within-participants (unconditional) phase and a between-participants (conditional) phase. In the unconditional phase, the goal was to determine the nature of growth and select an appropriate model of participants' growth. With only three time points in the present study, we were limited to linear models. We tested two alternative linear growth models to determine the model that most appropriately balanced goodness-of-fit and parsimony. These unconditional models centered time at the week during which the first teacher-submitted video was recorded (week 2). Thus, the intercept represented the teachers' practices at the beginning of the year. The first model allowed teachers to vary in the extent of strategy use at the beginning of the year (i.e., random intercept) but forced teachers to change at the same rate (i.e., fixed slope). This parameterization represents one of the simplest growth curve models, and its fit to the data was compared to a less parsimonious model in which teachers were allowed to vary in both intercepts and rate of change (i.e., random intercept, random slope). Overall model fit was determined through examination of residual

plots and using the $-2 \log$ likelihood difference test (Tabachnick & Fidell, 1996), the latter of which is a comparative fit index of goodness-of-fit versus parsimony. The most parsimonious model that adequately represented the data was selected.

In the conditional phase, we examined whether between-teacher differences in extent and change of strategy use differed by condition. Condition was dummy-coded (1 = treatment, 0 = comparison) and was used to predict intercept and slope parameters using the individual growth curve models selected in the unconditional phase. Effects of the condition were examined for models centered for weeks at the beginning (week 2) and end (week 24) of the project. Results were interpreted with respect to the significance of the dummy-coded condition variable. Significant effects on intercepts represented treatment versus comparison teacher differences in the extent to which responsivity strategies were used at the beginning of the year, representing impacts of PD immediately following the intensive group workshop over the summer, or end of the year, representing sustained impacts of PD approximately 8–9 months later. These analyses are akin to simple *t*-tests on the observed week 2 and week 24 composite scores for treatment versus comparison teachers; the growth curve analysis comparisons, however, are based on the fitted values at these time points and are therefore more precise. Significant effects on slopes represented treatment versus comparison teacher differences in change of strategy use.

A final set of conditional models sought to understand factors related to teachers' use of responsivity strategies. Teacher variables included attainment of 4-year college degree (0 = Associates degree or less, 1 = Bachelor's or Master's degree), total years of teaching experience, self-efficacy composite scores, and beliefs about children (modernity) composite scores. Continuous variables were grand-mean centered for analyses. Each variable was entered into growth curve models centered at week 24 and used as a predictor of the intercept, or the extent to which responsivity strategies were used at the end of the year. Interactions between teacher variables and treatment condition were also tested. Significant interaction effects indicated that use of responsivity strategies was related to teacher factors and these relations differed for those in treatment versus comparison conditions. Significant main effects, interpreted only in cases of non-significant teacher variable \times condition effects, indicated relations between teacher factors and responsivity strategy use, regardless of treatment condition. All analyses were conducted on both the original data as well as data in which outliers (i.e., values greater or less than the median plus or minus two interquartile ranges) were trimmed (Tabachnick & Fidell, 1996). Given that these sets of analyses were identical, only those conducted on the original data are presented.

5. Results

5.1. Teachers' responsivity strategy use

Descriptive statistics for general teacher variables are presented in Table 2 and for teacher use of two sets of responsivity strategies in Table 3 (separated by condition and time point). As shown in Table 2, teachers indicated moderate feelings of self-efficacy ($M = 3.60$, $SD = 0.50$) and beliefs about children that were slightly more child- than adult-centered ($M = 2.32$, $SD = 0.50$). As shown in Table 3, descriptive results concerning CRAFT scores indicated teachers' use of responsivity strategies generally in the low to moderate range in both the treatment and comparison conditions. Across conditions and time points, CRAFT composite scores averaged 2.67 for communication-facilitating strategies (possible range: 0–5) and 0.38 for language-developing strategies (possible range: 0–4). Note that language-developing strategies were not

Table 3
Teachers' CRAFT subscale composite scores across video submissions.

	Treatment				Comparison			
	<i>n</i>	<i>M</i>	<i>SD</i>	Range	<i>n</i>	<i>M</i>	<i>SD</i>	Range
Communication-facilitating strategies (possible range: 0–5)								
Week 2	25	2.872	0.466	1.60–3.93	21	2.681	0.453	1.40–3.33
Week 12	22	2.843	0.470	1.07–3.40	21	2.273	0.578	1.07–3.07
Week 22 ^a	3	3.044	0.500	2.53–3.53	0			
Week 24	17	2.922	0.338	2.27–3.87	21	2.354	0.631	1.00–3.27
Language-developing strategies (possible range: 0–4)								
Week 2	25	0.381	0.300	0.07–1.20	21	0.372	0.244	0.00–1.00
Week 12	22	0.367	0.227	0.00–0.87	21	0.387	0.227	0.00–0.80
Week 22 ^a	3	0.222	0.385	0.00–0.67	0			
Week 24	17	0.453	0.321	0.07–1.27	21	0.384	0.330	0.00–1.33

Note. The treatment condition had an overall sample size of 25 teachers. The comparison condition had an overall sample size of 24 teachers.

^a Three teachers in the treatment condition did not submit week 24 videos and thus had their week 22 videos coded as a third data point.

Table 4
Unconditional growth models for teachers' CRAFT subscale composite scores (centered at the beginning of the year).

	Fixed effects				Random effects				ICC (between-teacher variability)
	Coefficient	<i>t</i>	<i>df</i>	<i>p</i>	Estimate	Chi-square	<i>df</i>	<i>p</i>	
Communication-facilitating strategies									
Intercept	2.731	41.495	48	<0.001	0.029	56.705	46	0.134	0.266
Slope	–0.006	–1.267	48	0.212	0.000	52.101	46	0.248	
Language-developing strategies									
Intercept	0.359	11.036	48	<0.001	0.007	55.383	46	0.162	0.161
Slope	0.002	0.686	48	0.496	0.000	59.546	46	0.087	

frequently utilized by either treatment or comparison teachers, with a range of 0–1.33 on a 0–4 scale, consistent with prior reports in the literature (Pence et al., 2008).

5.1.1. Unconditional growth models

The unconditional models for both of the dependent variables (communication-facilitating strategies, language-developing strategies) are presented in Table 4. Also presented are the intra-class correlations (ICCs) for each outcome, representing the proportion of total variation in outcome due to variability between-teachers. The ICCs suggest considerable between-teacher variance in strategy use.

Random intercept, random slope models were used for teachers' use of communication-facilitating and language-developing strategies. Although neither the slope parameters nor the random coefficients for these models reached traditional levels of significance, the non-significant results may have been due to lack of statistical power, particularly for the random effects (Hox, 2002). Both the inspection of residual plots and $-2 \log$ likelihood model comparisons tests supported the random intercept, random slope models as fitting the data significantly better than the random intercept, fixed slope model, $\chi^2(2) = 7.77$, $p = 0.021$ for communication-facilitating strategies and $\chi^2(2) = 7.52$, $p = 0.023$ for language-developing strategies. Thus, for both of these dependent variables, teachers were allowed to vary in their levels of strategy use as well as their rates of change over time, resulting in the individual growth curves plotted in Figs. 1 and 2.

5.1.2. Conditional model: communication-facilitating strategy use

The conditional model (see Table 5), in which treatment status was included as a predictor of both intercept and slope, showed significantly better fit than the unconditional model when considering teachers' use of communication-facilitating strategies, $\chi^2(2) = 36.18$, $p < 0.001$. Descriptively, Fig. 1 shows that most treatment teachers (dotted lines) used communication-facilitating strategies to a greater extent than comparison teachers (solid lines) at the beginning of the year and appeared to maintain this

advantage through the end of the year, with a rather constant rate of use. Comparison teachers, on the other hand, tended to use communication-facilitating strategies to a lesser extent in the beginning of the year, with rates slightly decreasing over time.

The average treatment and comparison growth curves from the conditional model are bolded in Fig. 1. Statistical analyses indicated group differences in the extent of communication-strategy use at the beginning of the year, with a significant treatment \times intercept interaction when time was centered at week 2 (see Table 5). Treatment teachers tended to use more communication-facilitating strategies than comparison teachers, with the magnitude of this difference corresponding to the interaction coefficient of 0.28 (Cohen's $d = 0.61$). When the model was recentered at week 24, treatment teachers continued to show statistically greater use of communication-facilitating strategies over comparison teachers at the end of the year, coefficient = 0.64, $t(47) = 3.98$, $p < 0.001$, $d = 1.08$. Despite the trend for treatment teachers to maintain and comparison teachers to decrease their use of these strategies over the course of the year, group differences in slopes (i.e., the treatment \times slope interaction in Table 5) were not statistically significant.

Teacher factors (holding of 4-year college degree, years of experience, self-efficacy, beliefs about children) did not interact with treatment in predicting teachers' use of communication-facilitating strategies ($ps > 0.146$). Moreover, none of these factors showed significant main effects in predicting the extent of strategy use ($ps > 0.316$).

5.1.3. Conditional model: language-developing strategy use

The conditional model (see Table 5) in which treatment status was included as a predictor of teachers' use of language-developing strategies did not show significantly improved model fit over the unconditional model, $\chi^2(2) = 0.44$, $p = 0.802$. Inspection of Fig. 2 shows that patterns of language-developing strategy use were similar for both treatment and comparison teachers. Teachers in both conditions used language-developing strategies to various extents throughout the year. Most teachers remained relatively constant in their use of language-developing strategies, with a few teachers in both conditions increasing or slightly decreasing their strategy use

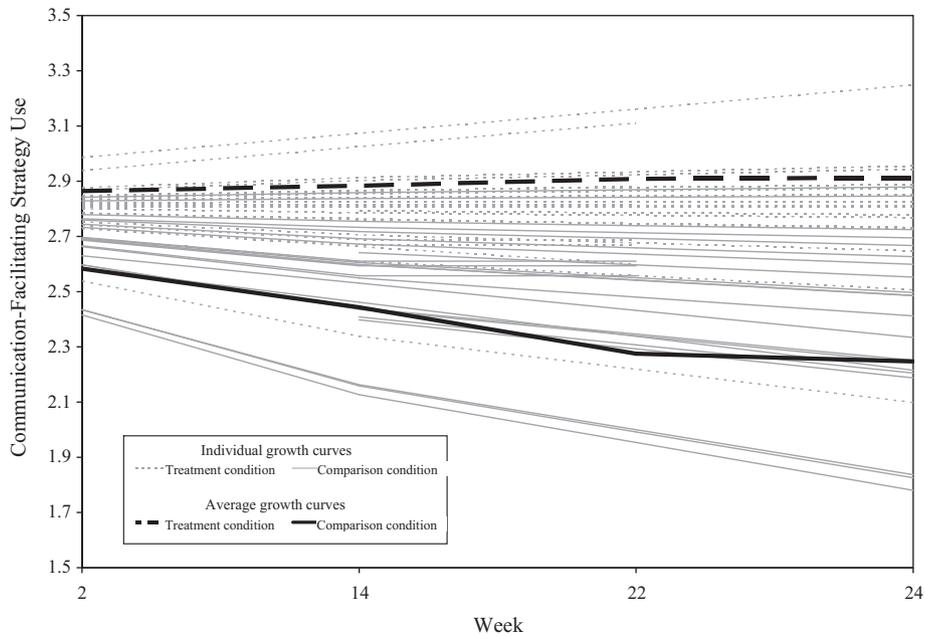


Fig. 1. Individual growth curves for treatment and comparison teachers on communication-facilitating strategy use.

Table 5

Conditional growth models predicting teachers' CRAFT subscale composite scores from treatment status (centered at the beginning of the year).

	Fixed effects				Random effects			
	Coefficient	<i>t</i>	df	<i>p</i>	Estimate	Chi-square	df	<i>p</i>
Communication-facilitating strategies								
Intercept	2.583	28.460	47	<0.001	0.010	51.067	45	0.247
Treatment × intercept	0.281	2.251	47	0.029				
Slope	-0.014	-2.068	47	0.044	0.001	50.623	45	0.261
Treatment × slope	0.016	1.704	47	0.094				
Language-developing strategies								
Intercept	0.373	7.898	47	<0.001	0.007	55.325	45	0.139
Treatment × intercept	-0.026	-0.406	47	0.686				
Slope	0.001	0.174	47	0.863	0.001	59.411	45	0.073
Treatment × slope	0.002	0.436	47	0.664				

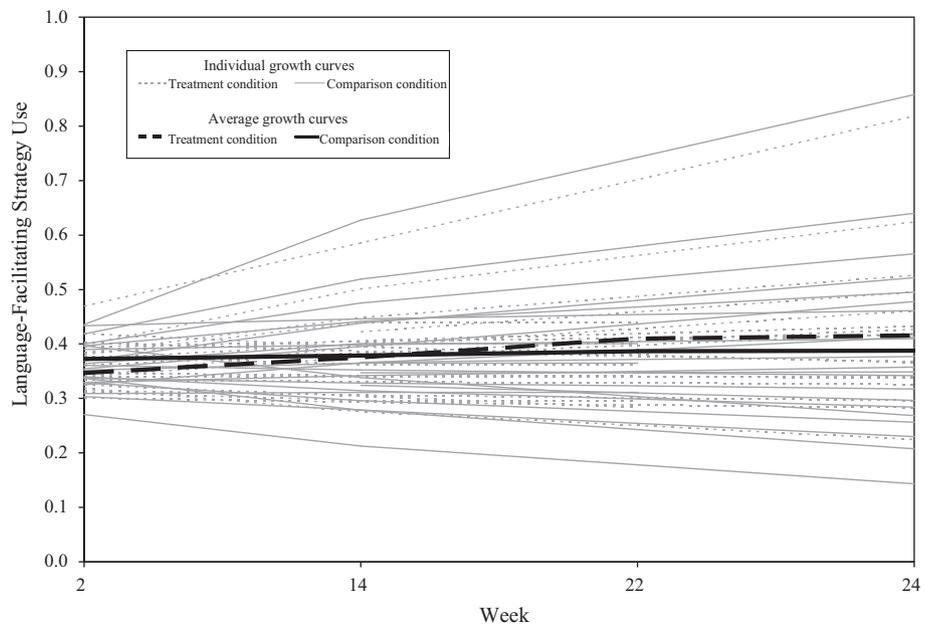


Fig. 2. Individual growth curves for treatment and comparison teachers on language-developing strategy use.

Table 6
Indices of children's linguistic complexity and productivity in small-group interactions.

	Treatment			Comparison		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Child total number of utterances						
Week 2	20	104.70	27.20	17	89.65	33.78
Week 24/22 ^a	20	113.70	29.43	17	84.41	43.96
Child number of different words						
Week 2	20	114.60	23.67	17	97.94	26.53
Week 24/22 ^a	20	140.85	27.33	17	96.00	37.01
Child mean length of utterance						
Week 2	20	3.86	0.77	17	3.31	0.64
Week 24/22 ^a	20	4.56	0.89	17	3.61	0.86

Note. The treatment condition had an overall sample size of 25 teachers. The comparison condition had an overall sample size of 24 teachers. Some teachers failed to submit videos as indicated for CRAFT coding and some videos submitted for CRAFT coding were deemed un-codable with respect to child language (e.g., poor sound quality); *n* represents the number of videos transcribed and included in analyses of child language.

^a Three teachers in the treatment condition did not submit week 24 videos and thus had their week 22 videos coded as their end-of-year data point.

across the year. Correspondingly, there were no significant differences between teachers in the two conditions in the extent to which language-developing strategies were used at the beginning of the year or in their rates of change across the year (see Table 5), nor did teachers differ in their use of language-developing strategies at the end of the year, coefficient = 0.02, $t(47) = 0.26$, $p = 0.798$. Similar to conditional models for communication strategies, teacher factors did not interact with treatment or otherwise predict teachers' use of language-developing strategies ($ps > 0.278$).

5.2. Children's linguistic productivity and complexity

Descriptive data concerning the three measures of children's language use during small-group interactions with their teachers at the beginning and end of the year appear in Table 6. These data were analyzed using mixed model analyses of variance (ANOVAs) with time point as the within-subjects factor and treatment status as the between-subjects factor. Results showed significant differences in treatment versus comparison children's language use for all three measures. Overall, children enrolled in treatment classrooms produced more utterances, used a greater variety of words, and produced more complex utterances than those in the comparison condition, as evidenced by significant main effects of treatment status for each outcome, Total Utterances: $F(1,35) = 5.45$, $p = 0.025$, $d = 3.18$, NDW: $F(1,35) = 15.18$, $p < 0.001$, $d = 5.30$, and MLU: $F(1,35) = 10.44$, $p = 0.001$, $d = 4.96$. Moreover, a significant time \times treatment status interaction modified this effect for NDW, indicating that children in treatment classrooms increased their variety of word use across the year to a greater extent than children in comparison classrooms, $F(1,35) = 7.13$, $p = 0.011$. Follow-up tests showed that children in treatment classrooms used a greater variety of words at the end of the year, $t(35) = 4.23$, $p < 0.001$, $d = 5.76$, but only a trend toward also using a greater variety of words at the beginning of the year, $t(35) = 2.02$, $p = 0.051$, $d = 2.75$. Time \times treatment status interactions were not significant for Total Utterances or MLU, $ps > 0.228$.

6. Discussion

The presented study investigated the extent to which PD could promote the conversational responsivity of educators working in targeted-enrollment preschool settings and thereby impact the proximal language skills of children in these classrooms. Three major findings of this work warrant discussion: (a) the generally low use of responsivity strategies coupled with considerable variation in the extent to which individual teachers utilized these strategies, (b) the significant impact of PD on teachers' use of communication-facilitating strategies designed to engage children

in extended conversations but not other strategies, and (c) the observed impacts of teachers' participation in PD on children's linguistic productivity and complexity within small-group interactions. These results, along with their implications for the quality of preschool language-learning environments and PD, are discussed below.

6.1. Conversational responsivity of preschool teachers

The first major finding of this work concerned the generally low frequency with which the 49 preschool teachers used conversational responsivity strategies in the fall of the year, particularly with respect to language-developing strategies. As coded from videotaped small-group interactions submitted by teachers to research staff, descriptive data showed extremely modest use of language-developing strategies, including labeling, recasts/expansions, explanations, and modeling of decontextualized language. On the CRAFT scale, scores close to 4 represent teachers' consistent use of all four such strategies across our observation whereas scores close to 0 represent lack of use of any of these language-developing strategies. While one might not anticipate teacher use of all four strategies during all cycles of coding, even the highest score on the CRAFT (1.33) indicated rather minimal use.

Although we found these data somewhat surprising, particularly in light of the current emphasis in both educational policy and research on elevating the language-learning environment of preschool classrooms, they are consistent with other research findings describing the generally low level of overt and explicit language facilitation that occurs in preschool settings, including those serving children considered at risk for academic difficulties (Dickinson & Tabors, 2001; Justice, Mashburn, Hamre, et al., 2008; La Paro et al., 2004; LoCasale-Crouch et al., 2007; Mashburn et al., 2008; Pence et al., 2008). Pence et al. (2008) employed a frequency count of preschool educators' use of seven language-facilitating strategies during a 2-h period of in-class observation, and found that teachers seldom used any of these strategies, even following PD. Girolametto et al. (2003) similarly found that early childhood educators only "sometimes" used three of five trained responsivity strategies (based on a 7-point rating scale) in a 10-min play-based interaction following PD. Such findings mirror the results of more global rating schemes. LoCasale-Crouch et al. (2007), in a study featuring cluster analysis as applied to 692 preschool classrooms, found that 67% of classrooms fit a profile characterized by the provision of low, poor, or mediocre instructional quality; additionally, while teacher characteristics (e.g., degree, years of experience) were not generally associated with the instructional quality of classrooms, child and program characteristics were. Indeed, classrooms serving a larger number of children from disadvantaged homes were more likely to exhibit poor instructional quality as

were programs affiliated with Head Start. Consequently, the findings of the present study converge with prior reports suggesting that the preschool language-learning opportunities available to children from disadvantaged backgrounds are quite modest. The present findings also argue the importance of research that continues to assess how the language-learning environments of preschool classrooms might be improved.

6.2. Impact of professional development on teachers' conversational responsiveness

The second major finding of this work concerned the impact of PD on teachers' conversational responsiveness, including the differential impacts observed across the two sets of strategies. Our results indicate that teachers who experienced this PD showed greater responsiveness to incorporating communication-facilitating strategies into small-group interactions compared to language-developing strategies, with uptake of the former differentiating these teachers from those in the comparison group. Specifically, treatment teachers were more adept at encouraging and involving children in extended conversations through use of expectant pauses, open-ended questions, slow pacing, and comments to cue additional turns. Interestingly, assessment of communication-facilitating strategy use over the academic year suggests that these teachers were relatively stable in use of these strategies over time. Differences in the use of such strategies between the two groups of teachers were moderate (beginning of the year) to large (end of the year; Cohen, 1988), suggesting that there was an immediate and lasting effect of PD on this aspect of teachers' conversational responsiveness.

It is possible that this result, in which treatment teachers used significant more communication-facilitating strategies than comparison teachers in the fall and maintained this level over time, is a function of the way the PD content was organized for teachers assigned to the treatment condition. Although the fall workshop provided information about each of the responsiveness strategies, the video schedule and written feedback letters received after each video indicated specific responsiveness strategies to serve as foci for each video (e.g., follow the child's lead for week 1), with communication-facilitating strategies preceding language-developing strategies. The pattern of findings (particularly in relation to impacts on the language-developing strategies, discussed shortly) might reflect the sequence of PD as it unfolded over the academic year, given that communication-facilitating strategies were emphasized first. Regardless, this finding is in keeping with previous research showing that PD has the potential to increase teachers' use of communication strategies that foster conversations (Girolametto et al., 2003; Girolametto et al., 2007; Wasik et al., 2006). Because participation in conversations with adults appears to be a critical means for fostering young children's language development (Zimmerman et al., 2009), this finding is a very positive one. Having opportunities to converse often with peers also is believed to provide an important route for language facilitation in early childhood settings (Mashburn, Justice, Downer, & Pianta, 2009).

Despite the positive benefits for teacher participation in PD with respect to communication-facilitating strategies, such differences were not observed in teachers' use of language-developing strategies. Looking more specifically at the patterns across the two groups of teachers with respect to use of language-developing strategies, the data on the treatment teachers show an interesting similarity to findings reported by Pence et al. (2008). In that work, in vivo observations of seven preschool teachers' use of language-developing strategies similar to those emphasized in the present study showed that teachers used the strategies at very low rates in the fall of the year, even after 15-h of PD, and trained and untrained teachers were indistinguishable in use of many

strategies. Trained teachers gradually, albeit modestly, increased their use of the language-developing strategies over the academic year, although many of these still occurred at very low rates (e.g., open-ended questions; see also Wasik et al., 2006). It might be that the language-developing strategies of interest in this work require significant investments of time for preschool teachers to make them routine parts of their interactions with children, and it is also possible that even with training, these occur at such low rates that it is difficult to distinguish trained from untrained teachers. Other studies that have involved much more intensive in-class coaching of teachers to use specific language-developing strategies has also found very minute differences between trained and untrained teachers on key strategies; in one study, for instance, teachers who had received extensive training to engage in informational talk during book-reading sessions were observed to use about two more instances of such talk than untrained teachers (Wasik et al., 2006).

Taken together, our findings are unique in that we documented use of both communication-facilitating and language-developing strategies over time; indeed, the differential patterns in strategies may suggest that provision of extended conversational interactions and overt, explicit language modeling are two distinct capabilities in teachers. Further, results of the present study regarding children's outcomes, as discussed subsequently, may be interpreted to show that teachers' use of communication-facilitating strategies are a particularly important active ingredient of PD aimed at increasing conversational responsiveness. That is, the differences between children's linguistic productivity and complexity within conversational interactions with treatment and comparison teachers, as observed in this study, might be interpreted as stemming from the treatment teachers' increased use of communication-facilitating strategies, given that these are what most vividly differentiated among teachers in the two conditions.

In discussing the findings regarding impacts of PD on teachers' conversational responsiveness, we must also point out the null finding that teacher characteristics were generally unrelated to the language support provided, and that our findings converge with those reported elsewhere (Dickinson & Caswell, 2007; Early et al., 2006; Justice, Mashburn, Hamre, et al., 2008; Pianta et al., 2008; Wasik et al., 2006). Justice, Mashburn, Hamre, et al. (2008) found that it was not possible to predict the quality of language instruction provided in 135 preschool classrooms from such teacher characteristics. Similarly, in the present work, none of the teacher characteristics examined (beliefs about children, educational degree, years of teaching experience, level of self-efficacy) moderated PD impacts, nor did these characteristics reliably predict extent of strategy use when considered across study conditions. Such findings may be viewed as promising, as they suggest that conversational responsiveness and the uptake of PD is not constrained by teacher background; teachers with high levels of education, for instance, were not necessarily the most adept at assimilating new PD strategies into their instructional routines.

6.3. Impacts on proximal measures of children's language skills

As in other studies of parents' and teachers' conversational responsiveness, impacts on proximal outcomes related to children's linguistic productivity and complexity were considered (e.g., Fey et al., 2006; Girolametto et al., 2003). The presumed influence of caregivers' responsiveness is that children, within interactions characterized by high levels of adult responsiveness, will talk more often, use a greater variety of words, and produce more complex utterances. With such opportunities, we expect children's language-development trajectory to be accelerated, as has been suggested in correlational studies of young children's language growth in relation to observed variations in caregiver responsiveness (see Landry et al., 1997). Indeed, the results of the present

study showed that children interacting with teachers who were participating in PD were more linguistically productive and used more complex utterances than children interacting with teachers employing their business-as-usual practices. The validity of the present findings are strongly supported given their coherence with results reported by Girolametto et al. (2003), in which children interacting with day-care providers who had completed the more intensive LLI training produced more sentences ($d = 1.5$) and more multi-word combinations ($d = 1.2$) compared to children interacting with untrained providers. The value of the present work, in extending Girolametto and colleagues' findings, is that the educators in the present study worked in targeted-enrollment preschool classrooms in which classrooms were largely populated by children from high-risk backgrounds, many of whom exhibited lags in language development. Findings suggest that PD focused on conversational responsivity may be a valid means for enhancing children's linguistic productivity and complexity within classroom routines, with the recognition that relations between such proximal language measures and more distal, standardized measures of language and literacy are inconsistent (e.g., Condouris, Meyer, & Tager-Flusberg, 2003). An additional unique feature of the present study is that impacts on children, as documented within the context of teacher-child interactions, were studied at two timepoints over the academic year. In this regard, we were able to determine that impacts of teachers' participation in PD were observed for children over the entirety of the academic year.

It is important to reconcile the present results regarding children's outcomes in conjunction with results our team has presented elsewhere (Cabell et al., 2011), showing much more limited impacts of teachers' PD participation on children's language outcomes. In that report, the language measures used were distal representations of vocabulary and grammar at the level of the individual child, whereas in the present study the language measures represented proximal measures of linguistic productivity and complexity, in the aggregate. On the one hand, it is certainly desirable that interventions such as that studied here demonstrate immediate impacts on distal measures of achievement, as such measures have strong validity to various constituents including administrators and policy-makers. Interventions that do not have observable impacts on standardized tests, for instance, often are not considerable worthwhile investments, with Head Start representing an obvious example (Puma et al., 2010). On the other hand, it is also the case that distal measures of achievement are typically not constructed to be sensitive to intervention impacts, and it is often the case that measures more closely aligned to interventions are those that provide the most accurate representation of whether an intervention does or does not work. In the area of vocabulary interventions, for instance, it is often the case that an intervention exhibits significant positive impacts only on measures closely aligned to the intervention but not on more distal measures (Coyne et al., 2010). In such instances, it is difficult to conceptualize an intervention as effective or not. With respect to the present work, it is our opinion that an intervention which results in children talking more often, using a broader array of words, and producing more complex sentences should be viewed positively. The extent to which these may translate into longer-term gains for individual children, into the early primary grades, is an obvious route for future research in this area.

6.4. Limitations and future directions

Several limitations of the present study warrant note. First, our instrument of teacher strategy use may not have been sensitive enough to measure the amount of teacher uptake or change in teachers' strategy use over time. Although the CRAFT was explicitly designed to assess teachers' use of conversationally responsive

strategies taught during PD, it is possible that a more nuanced examination of teachers' language and behaviors would reveal further differences between teachers in the treatment and comparison conditions. Relatedly, we also note that teachers' strategy use was assessed based on videos collected and submitted by teachers; it is possible that teachers submitted videos that depicted them favorably and thus the results may not generalize to their teaching practices in general. Nonetheless, we contend that the methods of this study support the validity of our findings, given that teachers' communicative interactions with children were assessed not only in vivo but in continuously coded interactions (versus more global or qualitative impressions), and also captured in the absence of researchers being within their classrooms as has been more typical (e.g., Girolametto et al., 2003; Wasik et al., 2006).

Second, it is also necessary to point out limitations related to the context in which we studied teacher-child interactions, namely small-group play-based sessions of varying group sizes. It is not clear whether alterations in teacher responsivity observed in small-group interactions generalize to what happens across the entire day, and we recognize that the small-group interactions that we observed represent only one aspect of children's daily experiences in a preschool classroom. It is also possible that teachers' implementation of these strategies could be influenced by the size of the group, which varied in this study to a modest extent. Moreover, we also recognize that teachers may employ techniques to foster the language learning of their students beyond the communication-facilitating and language-development techniques assessed in this study, such as informational talk (Wasik et al., 2006). This is an important point of emphasis given that some of the strategies with which we were interested occurred at relatively low rates. It might be that more extensive observations of classroom interactions across the day or an expanded corpus of strategies would have yielded interesting differences between the treatment and comparison teachers.

Third, the present study focused on group differences in teachers' immediate and sustained use of responsivity strategies as a result of PD. Although intra-individual differences are also suggested by the growth curve analyses, we make no claims concerning fluctuations in teachers' responsivity from the fall to the spring across the preschool year. Studies using larger samples and more than three time points are required to better understand such patterns.

Fourth, teachers and children in this study represented participants in targeted enrolled preschool classrooms, designed to serve at-risk populations. It is unclear whether findings would generalize outside of these settings – for instance, in home-based programs or for-profit private day cares – and to children who are not eligible for these subsidized programs.

The results presented in this manuscript provide interesting and important avenues for future research. For instance, future research should examine whether the current results regarding PD impacts on teachers' strategy use generalize to other classroom activities and techniques. Findings presented here focused exclusively on teachers' interactions with children in small groups. Perhaps other contexts give rise to more and higher-quality conversations between teachers and children, such as dramatic play or large-group meeting time. This should be explored. Moreover, the present study sought to promote teachers' utilization of conversational techniques with offline and fairly modest coaching. Although this can be conceived as a limitation of this work, given that more intensive, on-site coaching appears to positively affect aspects of teachers' conversational responsivity (see Girolametto et al., 2003; Wasik et al., 2006), there is a great need for systematic assessment of how various intensities of and approaches to PD may impact teacher-child interactions and children's language development. Indeed, the research on coaching presents mixed findings in its

impacts on instructional quality (Pianta et al., 2008; Powell et al., 2010). Nonetheless, it is not clear that the “reduced” version of PD presented here had reduced impacts on teachers and on children, as compared to the more intensive version of LLLI described in extant reports (Girolametto et al., 2003) and it would be quite interesting to compare various approaches to implementing LLLI within a single experimental study. Given that the ways in which teachers and children interact within preschool classrooms is seen as a salient mechanism for change in children’s language skills, it is necessary that researchers seek to identify how to improve these interactions through the professional development of educators. Finally, the results of this work, in suggesting that teachers’ participation in PD may have positive impacts on children’s linguistic productivity and complexity within interactions with their teachers, shows that this avenue of PD represents a fruitful area of continued investigation. It may be that helping teachers to enhance their responsiveness to children, even in absence of any specialized curricula or materials, may be an effective route to boosting children’s language skills in the near-term and, perhaps, longitudinally.

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