



Teacher–child conversations in preschool classrooms: Contributions to children’s vocabulary development[☆]



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ABSTRACT

This study used a novel method to examine the volume and quality of teacher–child conversations within 44 preschool classrooms. Small group play sessions were transcribed, parsed into conversations, and coded for teachers’ use of strategies that elicited and extended child talk. The first research aim was to examine the extent to which professional development impacted teachers’ strategy use during conversations with children, whereas the second aim was to consider the way in which teachers’ strategy use related to gains in children’s vocabulary across the preschool year. Regarding this second aim, of principal interest was the relation between the pattern of teachers’ strategy use (concentrated versus distributed) and children’s gains. Findings indicated that professional development increased teacher–child engagement in multi-turn conversations, child-initiated conversations, and teachers’ strategy use. In addition, teacher–child conversations with a high concentration of teacher elicitations and extensions were positively associated with children’s vocabulary gains. This study increases our understanding of what teacher–child conversations look like in preschool settings, and helps to advance the field in terms of identifying features of conversations that may promote children’s language growth.

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Introduction

Participation in high-quality preschool programs can serve as an important mechanism for enhancing children’s language skills, particularly in the area of vocabulary knowledge (Mashburn et al., 2008). For instance, having daily opportunities to converse with teachers and engage with their peers can provide young children with opportunities to learn novel words and to extend the meanings of these words in conversations with others (Christ, Wang, & Chiu, 2011). Yet, many preschool classrooms serving children living in poverty appear to offer limited opportunities

for children to have multi-turn conversations with their teachers and their classmates (Justice, Mashburn, Hamre, & Pianta, 2008; LoCasale-Crouch et al., 2007). As a result, researchers are actively studying ways to improve the volume and quality of children’s language-learning experiences in preschool settings, to include efforts to increase teachers’ use of *responsive strategies* that encourage children to participate in conversations (Cabell et al., 2011; Dickinson & Porche, 2011; Girolametto, Weitzman, & Greenberg, 2003; Piasta et al., 2012; Wasik & Hindman, 2011a). These strategies include inviting children to initiate conversations, prompting turn-taking, and building on children’s talk. The generally limited impacts of professional development (PD) on teachers’ use of these techniques (Girolametto et al., 2003; Piasta et al., 2012), however, suggest a need to further refine our understanding of how to improve teacher–child conversations in preschool settings (Dickinson, Freiberg, & Barnes, 2011).

In the present study, we conducted an investigation of the volume and quality of teacher–child conversations taking place in 44 classrooms. This work represents follow-up analyses to two recent papers on the impacts of PD on teacher responsiveness in the preschool classroom as well as child language skills (Cabell et al., 2011; Piasta et al., 2012). The primary goal of the present study

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was to understand the pattern of responsive strategy use across teacher–child conversations and learn how these may be associated with children’s vocabulary development over a preschool year. A novel contribution of this work is that we identified discrete teacher–child conversations and examined two patterns of strategy use across them: distributed and concentrated. A distributed pattern involved teachers using relatively few strategies within any single conversation and rather distributing them over a number of conversations, while a concentrated pattern involved teachers embedding numerous strategies within fewer conversations.

Given that the present study involved data available from a randomized controlled trial (RCT), we included assessment of the impacts of PD on specific features of teacher–child conversations not investigated in our prior work. These features included conversational length, number of conversations, the extent to which children verbally initiated conversations, and strategy frequency. These post hoc impact analyses added additional information to our extant findings from the larger RCT. The framework for this study is provided by prior research establishing: (a) the general importance of teacher–child conversations as a mechanism for child language acquisition, and (b) the role of specific strategies within conversations as influential to children’s vocabulary development.

The importance of teacher–child conversations

It is generally accepted that preschool teachers should talk often to children, that is, have frequent, linguistically rich, and meaningful conversations with children in their classrooms (National Association for the Education of Young Children, 2009). Both theory and research suggest that these back and forth verbal exchanges are critical for accelerating children’s early language development (Weizman & Snow, 2001), and a recent study of parent–child talk in the home suggested that conversations may be even more influential to children’s language growth than adult–child storybook reading (Zimmerman et al., 2009). Other work has shown that parental engagement of their children in conversations about recent shared events (i.e., reminiscing) can improve children’s memory as well as their language abilities (Reese & Newcombe, 2007). For our purposes, we define *conversation* as a group of semantically contingent utterances between two or more speakers that comprises multiple turns on the same topic (i.e., each speaker talks at least one time). A *turn* is defined simply as what one speaker says about a particular topic and may include several consecutive utterances. The following therefore represents one conversation comprising two turns:

Teacher: Are you going to wash your hands, Brooklyn? Brooklyn, please wash your hands.

Brooklyn: I don’t want to.

Many conversations in preschool classrooms may, in fact, look like the above, with relatively long teacher–child exchanges being the exception rather than the norm (Justice, Mashburn, Hamre et al., 2008). However, participating in conversations that span multiple turns may provide an important framework in which children acquire and expand their vocabularies. Conversations are mechanically important to children’s acquisition of new vocabulary words because they provide children with highly informative encounters with novel linguistic forms; that is, a high volume of cues that support children’s acquisition of new lexical forms (McGregor, Sheng, & Ball, 2007). For instance, a teacher talking with a young child might say, “Let’s put this block here to make the tower really big,” in which “tower” is novel to the child. In the context of this conversation, the novel word is accompanied by social cues (the teacher waves her hand upwards denoting that towers go upward and are tall, the teacher looks to the child and then the blocks)

and lexical cues (the teacher provides details about the meaning of tower, including that they are ‘big’).

A conversation can also support vocabulary development by increasing children’s networks of semantically related words. For example, a teacher may use many familiar or unfamiliar words related to “tower” that deepen the meaning of the acquired word and introduce new words (e.g., moat, castle, princess). Interestingly, experimental studies involving young children show that conversations that occur near a child (but not with a child) may also serve to support children’s vocabulary development; specifically, young children learn new words just from overhearing the conversation of others (Akhtar, Jipson, & Callanan, 2001). Children’s ability to use such cues to extract information about novel words emerges early and helps to explain the sheer volume of word-learning that takes place over the toddler and preschool years (Houston-Price, Plunkett, & Duffy, 2006).

Increasing the volume and quality of conversations in preschool classrooms

Accepting that conversations are well established as being important to young children’s vocabulary development, a somewhat separate issue in the literature concerns how to help adults to increase the volume and quality of their conversations with children. Largely, this literature involves helping teachers (and parents) to be *conversationally responsive partners* with children. This literature spans caregiver studies, in which the interest is to promote caregivers’ talk with their young children, oftentimes focused on caregivers at-risk themselves (e.g., young mothers, depressed mothers; Albright & Tamis-LeMonda, 2002) or whose children are at-risk (e.g., exhibit language disabilities; Fey et al., 2006; Girolametto, 1988), as well as teacher studies, in which the goal is to promote teachers’ talk with young children in the classroom (Girolametto et al., 2003; Wasik, Bond, & Hindman, 2006). To craft such PD studies well, it is important to identify the specific ways in which adults can evoke talk from children and, in turn, respond to this talk in recursive patterns that build conversations.

Examination of adult–child conversations suggests that adults’ use of certain responsiveness strategies that *elicit* and *extend* child talk explicitly serve to promote children’s participation in conversations. Teachers’ use of these conversation-promoting strategies is positively correlated ($r_s = 0.50–0.65$) with how much children talk in small-group interactions with their teachers (Girolametto & Weitzman, 2002). Elicitations are efforts to evoke talk from children, typically through questioning. Open-ended questions (e.g., “How do you think the window got broken?”) are often discussed in the literature as an important strategy for eliciting talk from children, as the function of an open-ended question serves to evoke an elaborate response from the child in terms of the information shared and the complexity of the utterance. Evidence shows that children respond at much higher rates to direct elicitations (questions, requests) than non elicitations, such as comments (Justice, Weber, Ezell, & Bakeman, 2002). Extensions follow a child’s contribution to a conversation and directly build on a child’s topic to provide more information or explanation. These are also described as topic continuations, because the adult seeks to use an extension to maintain a conversation on a given topic. Extensions appear to serve to maintain children’s participation within multiple-turn conversations by prompting them to contribute further information about their topics (Child: “Fifty dollars.” Teacher: “Where do you think I can get fifty dollars?”) At the same time, extensions may promote children’s vocabulary skills as the adult and child share an attentional focus during word exposure, thus effectively reducing the child’s cognitive demand (McCathren, Yoder, & Warren, 1995; Nelson, 1989; Tomasello, 1988).

Learning Language and Loving It.

Given the importance of elicitations and extensions to children's volume of talk and language growth in preschool and longitudinally (Dickinson & Porche, 2011; Justice, Mashburn, Hamre et al., 2008; Mashburn et al., 2008; Whitehurst et al., 1994, 1999; Zucker, Cabell, Justice, Pentimonti, & Kaderavek, 2013), there have been efforts to directly teach educators how to use these in their classroom through PD (Girolametto et al., 2003; Justice, Mashburn, Pence, & Wiggins, 2008; Pence, Justice, & Wiggins, 2008; Piasta et al., 2012; Powell et al., 2010; Wasik & Hindman, 2011a). Recently, our research team examined impacts of PD provided to early childhood educators that featured *Learning Language and Loving It* (LLLI; Weitzman & Greenberg, 2002), a PD program designed to increase adults' use of responsive strategies as a means to becoming better conversational partners with children (Cabell et al., 2011; Piasta et al., 2012). LLLI builds upon considerable work showing that responsive adults promote children's active participation in multi-turn conversations through the use of non-verbal (e.g., pausing and waiting for children to respond) and verbal cues (e.g., asking open questions, extending children's productions; Bonifacio et al., 2007; Fey et al., 2006; Girolametto & Weitzman, 2002; Landry, Smith, Miller-Loncar, & Swank, 1997; Yoder & Warren, 2002). Our training included workshops and ongoing feedback provision that taught 25 teachers to use two global sets of strategies that promote children's participation in extended conversational exchanges (communication-facilitating strategies, which included open-ended questions among the larger corpus of strategies) and exposure to advanced linguistic models (language-developing strategies, which included extensions). An overall goal of the PD was for teachers to engage children in multi-turn conversations, with four turns considered the minimum target length.

Mixed findings characterized the results of this RCT. First, participation in the PD served to increase teachers' use of strategies that facilitate children's opportunities to communicate, but not those designed to directly improve children's language skills (Piasta et al., 2012). Second, children in PD classrooms were observed during classroom-based interactions to talk more and to use more complex language than those in the control classrooms ($d_s = 3.18, 4.96$, respectively), but these proximal results did not translate to improved performance on distal language measures (i.e., standardized norm-referenced assessments) for children in PD classrooms (Cabell et al., 2011).

To unpack whether strategy use (when examining these global sets) related to gains on standardized language measures, we examined these relations irrespective of condition because untrained teachers exhibited natural use of these strategies. Findings revealed that communication-facilitating strategy use was positively related to children's vocabulary gains (Cabell et al., 2011). However, we could not examine the relation of language-developing strategies to vocabulary development because of the low occurrence and restricted range of the strategies.

It is important to note that global strategy use was measured by coding the presence of a given strategy within 30-s intervals of video observation. While partial interval coding is in keeping with the extant literature (Zucker et al., 2013), it provides an approximation, rather than a precise estimate of the frequency with which teachers use strategies during an observation. For example, during a 30-s interval, teachers may extend children's talk three times, yet an interval coding system would count this only once for the time period. By examining strategy use at the utterance level via the use of transcripts (and by including only utterances that were parts of teacher-child conversations), we were able to add precision to our prior work with regard to strategies that elicit and extend child talk. In addition, scrutinizing utterances using transcripts instead of direct video observation may enable deeper analysis, resulting in

a truer estimation of strategy use and allowing for consideration of the relation between the frequency of elicitations/extensions and vocabulary knowledge.

The present study also builds on our prior work by examining the impact of the intervention on quality features of teacher-child conversations themselves, including children's exposure to multi-turn conversations (\geq four turns). Prior research has also generally assumed that conversations continuously occur in classrooms, and thus has analyzed all utterances within a given observation time frame (e.g., 10 min). Yet there is much talk in classrooms that is not actually part of conversations (e.g., children's statements that receive no response, prolonged episodes of teacher instruction). In the present study, we make conversations themselves an explicit focus by parsing into conversations semantically contingent utterances across the observation period and by removing from analyses talk not occurring within the context of teacher-child conversations. It is important to note that although semantically contingent talk is generally considered an important feature of classroom talk, the vast majority of studies on conversational interactions do not operationally define conversations in this way and thus this investigation represents a novel way to analyze conversations.

Determining whether PD designed to impact the volume and quality of conversations within the preschool classroom actually affects this outcome is important for scientific reasons (i.e., to learn whether this PD program impacts the outcome it is designed to affect), but also for practical ones, as it helps us understand whether teacher-child conversation is a malleable construct (i.e., a construct that can be affected through interventions). To our knowledge, no prior study has explicitly sought to determine impacts of an intervention on the quality features of teacher-child conversations in early childhood settings, despite these being viewed as important mechanisms to children's language growth.

Patterns of strategy use within the context of conversations

In considering teachers' use of elicitations and extensions, we not only examined frequency of strategy use, we also examined two patterns regarding spacing of implementation (Proctor-Williams & Fey, 2007). A *distributed* (i.e., spaced) pattern occurs when teachers use relatively few strategies within any single conversation but distribute them over a number of conversations; a *concentrated* (i.e., massed) pattern occurs when teachers embed numerous strategies within fewer conversations. Presuming that teachers' use of elicitations and extensions are an important mechanism for not only increasing children's participation in conversations but also their vocabulary growth within conversational contexts, literature on spacing effects generally suggests that a distributed (or spaced) pattern of exposure to these strategies may be most influential to children's gains (Dempster, 1989; Vlach, Sandhofer, & Kornell, 2008). In a distributed pattern, teachers would space their use of strategies across a number of conversations, whereas in a concentrated pattern, strategies would be clustered within some conversations.

Teachers trained to use elicitations and extensions show variability in the way that they space their use of these strategies. Table 1 illustrates this difference with two hypothetical transcripts of teacher-child conversational interactions. Transcripts for both Teacher One and Teacher Two are the same length with regard to the number of turns taken by teachers and number of strategies to elicit and extend child talk. Yet, Teacher One uses four strategies across three conversations with children, whereas Teacher Two uses four strategies within one conversation with children, with no strategies used in two other conversations. Although these teachers exhibit the same volume of strategy use, it may be theorized that variations in spacing may be influential to children's vocabulary growth. However, the extant literature

Table 1
Hypothetical examples of teacher–child conversations reflecting distributed and concentrated patterns of strategy use.

During free play, children are making shapes out of play dough. Each teacher has three conversations with children. Teacher One uses a distributed pattern of strategy use, as she uses four strategies across three distinct conversations with children. Teacher Two uses a concentrated pattern of strategy use, as she uses four strategies within one conversation and no strategies in two other conversations.

Teacher One (distributed pattern)

Teacher: Devin, what are you working on? (elicitation)
Devin: Look!
Teacher: I like that. That's a very nice mountain. (extension)
Devin: Thank you.
Teacher: You're welcome.

Teacher: Kelly, what are you working on? (elicitation)
Kelly: I don't know.
Teacher: You don't know?
Kelly: No.

Michael: I made a cupcake out of mine.
Teacher: Oh that's a big cupcake. Let me eat it. (extension)
Michael: Okay.
Teacher: Chocolate, is that what that is?
Michael: Uh huh.
Teacher: I like chocolate.

Teacher Two (concentrated pattern)

Devin: I made a mountain.
Teacher: You made a mountain.
Devin: Yeah, it's a big mountain with lava.
Teacher: It's a big mountain with lava?

Teacher: Kelly, what are you working on? (elicitation)
Kelly: I don't know.
Teacher: You don't know? Tell me about what you are making. (elicitation)
Kelly: Flower.
Teacher: Oh, you are making a flower with petals and leaves. (extension)
Kelly: Yeah, I love my flower.
Teacher: I do too. It looks like a tulip. (extension)

Teacher: Michael, are you making a cupcake?
Michael: Yes.
Teacher: Is it chocolate?
Michael: Yes.

provides conflicting evidence on whether a distributed versus concentrated approach to strategy use would be most beneficial to children's vocabulary development.

On the one hand, a considerable volume of theoretical and empirical work on spacing effects would anticipate that the more distributed pattern used by Teacher One would result in enhancing language growth (Dempster, 1989). Although there have been concerns regarding the extent to which laboratory-based findings of spacing effects (which support distributed learning opportunities) might generalize to authentic learning contexts, a recent study of spacing effects within the classroom, specific to vocabulary development among fifth graders, showed that distributed learning opportunities had superior outcomes for students' learning relative to concentrated, or massed, opportunities (Sobel, Cepeda, & Kapler, 2011). Additionally, a controlled study of the effects of recasts, which is language modeling strategy in which adults respond to children using advanced grammatical models, showed that typically developing five- and six-year-old children benefited more from a distributed pattern of recast exposure relative to a concentrated pattern (Proctor-Williams & Fey, 2007).

On the other hand, however, research on spacing effects has not focused on real-time conversations between children and adults, which are an important mechanism for improving children's skills (Zimmerman et al., 2009). We might speculate that adult-child conversations that involve a concentrated pattern of adult use of elicitation and extensions may be particularly beneficial for children's vocabulary growth, as these would tend to provide children with more informative encounters with novel words than a distributed pattern. Recall that highly informative encounters with novel words within conversations, in which adults provide many varied cues to map the meanings of new word, are more beneficial to vocabulary growth than less informative encounters (McGregor et al., 2007). If this were the case, we might speculate that children's experiences in conversations that are highly concentrated with teachers' strategies that facilitate learning would be more beneficial to vocabulary growth, over time, than experiences in conversations that are less concentrated. Recent dose-response research in the area of early literacy intervention suggests that this might be the case: fewer intervention sessions that feature a relatively high concentration of learning opportunities resulted in greater learning gains for preschool-aged children than more frequent sessions with a relatively lower concentration of

learning opportunities (McGinty, Breit-Smith, Fan, Justice, & Kaderavek, 2011).

More to this point, support for the potential importance of concentration of strategy use also comes from the extensive research base involving shared book reading. In particular, the extra-textual conversations surrounding the book-reading experience relate to children's vocabulary gains in preschool, with sustained associations seen into kindergarten and fourth grade (Dickinson & Porche, 2011; Dickinson & Smith, 1994; Zucker et al., 2013). The most successful preschool vocabulary interventions feature shared book reading as a central focus (National Early Literacy Panel [NELP], 2008), including dialogic reading in which teachers use a high concentration of strategies within a read-aloud (prompt, evaluate, extend, repeat) to engage children in conversations. Dialogic reading has repeatedly shown to increase children's vocabulary skills (Mol, Bus, de Jong, & Smeets, 2008; NELP, 2008; Whitehurst et al., 1994, 1999), and provides a case for anticipating that highly concentrated exposures to teachers' use of elicitation (prompts) and extensions is an important mechanism for promoting vocabulary skills.

Aims of this study

Research aims were twofold. The first aim considered the impacts of PD on the volume and quality of teacher–child conversations. Specifically, we examined the extent to which LLLI teachers engaged in longer conversations, more multi-turn conversations, and more child-initiated conversations relative to control teachers. In this way, we extended our prior work (Cabell et al., 2011; Piasta et al., 2012). Additionally, we examined the extent to which LLLI impacted teachers' frequency of elicitation and extensions, both representing important strategies for improving children's participation in conversations, as well as the pattern that characterized use of these strategies (concentrated or distributed). Although we hypothesized that the intervention would result in teachers' engagement in more and longer conversations as well as more child-initiated conversations, we did not have a specific hypothesis regarding the pattern of strategy use, as this was not an explicit focus of the intervention. The second aim considered more generally the way in which the pattern of teacher–child conversations, with respect to concentrated and distributed use of strategies, was related to children's gains in vocabulary over the preschool year. As aforementioned, the extant literature provides

mixed guidance with respect to whether a concentrated versus distributed pattern might be most advantageous to predicting children's vocabulary growth over time.

Methods

Participants

Participants were 44 preschool teachers and a random sampling of 297 children from their classrooms (160 boys, 137 girls; approximately seven per classroom). The present study used data collected as part of a larger study examining the effects of a classroom-based language intervention and included all but five of the original 49 classrooms ($n = 330$ children) from this broader effort (Cabell et al., 2011; Piasta et al., 2012). The larger study was designed to examine the impacts of a PD program (LLLI) on teachers' conversational responsivity in the classroom and child language and literacy gains. Stratified by geographical region, 38 preschool centers were randomly assigned to condition. Only five of these centers housed more than one preschool classroom. Random assignment at the center level guarded against the potential threat of contamination in these centers.

Exclusion of classrooms for the present study occurred because some participating teachers did not submit the necessary classroom videotaping used to address this study's focus. The five excluded classrooms did not differ from the included classrooms in terms of teacher experience [$M = 10.80$, 9.62; $t(45) = -0.37$, $p = 0.88$] or whether teachers held a Bachelor's degree [$\chi^2(1, N = 47) = 0.70$, $p = 0.40$]. Further, children in excluded classrooms did not significantly differ in racial/ethnic make-up [$\chi^2(1, N = 257) = 0.97$, $p = 0.33$], highest level of maternal education [$M = 2.34$, 2.82; $t(259) = -2.16$, $p = 0.85$], or age [$M = 52.79$, 51.86; $t(328) = -0.926$, $p = 0.68$].

The teachers in this study were all lead teachers and taught within preschool programs (Head Start, state-funded pre-k) prioritizing enrollment of young children from low-income households or children experiencing other documentable risk factors (e.g., low parent education; violence in the home). Of the teachers reporting their demographic data (42 of the 44), the majority were Caucasian (66.7%), one quarter were African American (26.2%), two were multi-racial (4.8%), and one was Native American (2.4%). Teachers, on average, had a number of years of teaching experience (mean years teaching preschool = 9.62 [SD = 6.74]); however, teachers varied in their highest level of educational attainment (21.4% Master's degree, 38.1% Bachelor's degree; 35.7% two-year degree; 4.8% no post high school degree). There were no significant differences across condition with regard to teacher experience or level of education. All teachers employed either The Creative Curriculum for Preschool (92.9%; Dodge, Colker, & Heroman, 2002) or High/Scope (7.1%; Hohman & Weikart, 1995) as their main curriculum.

The participating children were four to five years of age at the beginning of the study ($M = 51.86$ months; $SD = 5.5$ months, range = 40–66). They were primarily Caucasian (44.1%) or African American (34.3%), with a small representation of children who were multi-racial (6.4%), Hispanic (4.7%), or other (non-specified; 2%); race/ethnicity was not reported for 8.4% of child participants. Of the parents who completed a demographic survey (approximately 81% of the full sample), 97.5% reported that children spoke English at home. Parental report also indicated that mothers' educational attainment was generally low in that that 24.4% of mothers had not completed high school, 30% held a high school degree, 35.7% had completed some college or additional training beyond high school, 6.3% had a two-year degree, and 3.3% held a four-year degree or higher.

General procedures and measures

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.

Data included classroom observations of small-group activities and direct assessments of children's vocabulary skills. Classroom observational data were collected by teachers (i.e., they taped themselves) and submitted to the research team for processing and coding. All teachers were provided with video recording equipment along with standard training on video recording. Teachers submitted videotapes of themselves leading a 20-min pre-specified activity on a biweekly basis across the academic year. The present study focuses on a videotape of a small-group play-dough activity submitted by each teacher in the second semester of the academic year. For this video submission, teachers were asked to collect a video of a play-dough activity conducted with a small group of children (six children or less); although they were asked to randomly select these children, there were no formal procedures in place for this selection. Teachers were instructed to be actively involved in the children's play and, for those teachers in the LLLI PD program to use responsivity strategies they were learning about in PD. All videos were examined carefully to ensure that they represented a small group setting with a teacher present during the interaction. Videos submitted in April were considered for inclusion; if these videos were not available or did not meet the guidelines, we substituted a video collected in January that represented the same setting (i.e., small group play-dough). All analyzed videos were collected after teachers received the winter workshop training.

Direct measures of children's vocabulary 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.

Teacher PD

Teachers were assigned to one of the two conditions: participation in an extensive PD program focused on conversational responsivity (LLLI) or a control condition, in which they maintained their typical classroom practices.

Treatment condition

The PD package for teachers assigned to this condition contained two components: (1) direct training designed to increase teachers' conversational responsivity in the classroom, and (2) access to a consultant who provided off-site coaching throughout the academic year. The professional development program was based on LLLI (LLLI; Weitzman & Greenberg, 2002), as noted previously, with permission from the Hanen Center. The program as manualized in the LLLI manual and described in prior research reports (Girolametto et al., 2003) involves eight 2.5-h sessions plus in-class

mentoring of participants. Each session focuses on presenting specific strategies that help to engage children in conversations and stimulate their language. For this PD study, all sessions were condensed into two one-day workshops held in the fall and winter of the year, with reading portions of the LLI manual distributed over the academic year. Of particular relevance to the present analyses, the workshops included role-playing scenarios that involved teachers practicing strategy use within a play-dough activity.

In addition, each teacher was assigned to a trained research assistant who served as an off-site consultant. Teachers received video recording equipment, recording media, and training on how to use this equipment. They were provided a schedule instructing them to submit videotapes every two weeks; this schedule included information on which strategies to use, the activity (e.g., play-dough), and the number of children to include. The consultant's primary role was to view videos submitted throughout the year 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. Intervention fidelity was measured by examining strategy use during the play-dough group setting at fall, winter, and spring time points using a partial-interval observation tool. Intervention teachers used significantly more communication-facilitating strategies designed to facilitate ongoing conversation with children [see Cabell et al. (2011) and Piasta et al. (2012) for additional details regarding the intervention condition and fidelity].

Control condition

Teachers assigned to the control condition also attended fall and winter in-service workshops, to address Hawthorne effects. However, PD 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 identical video recording equipment and associated training. They were also provided with a video submission schedule identical to the treatment schedule with submission dates, activities, and number of children to include in each activity; the only difference is that it did not include specific responsibility strategies to use. Control teachers were given access to off-site consultants who either provided generic feedback regarding best practices in early childhood education or no feedback apart from an acknowledgment that the tape was received.

Video coding

Teacher and child talk during videotaped play sessions was transcribed and each transcript was parsed into a series of conversations. One video for each of the 44 classrooms was coded for the purposes of this study.

Video transcription

Research assistants trained in using the Systematic Analysis of Language Transcripts software (SALT; Version 9; Miller, 2006) transcribed teacher and child talk during a segment extracted from teachers' submitted videos. Specifically, the middle 10 min of the 20-min videotape was extracted, which served to eliminate times in which the teacher was setting up and closing down the activity and to make the transcripts across teachers more uniform with respect to what was coded. During transcription, each teacher and child utterance was parsed at the level of the T-unit and was entered as a separate line in the SALT software, adhering to SALT codes and conventions (Miller, 2006). A T-unit represents an independent clause and any dependent constituents (phrases, clauses), and represents one way to parse connected speech.

Transcription was conducted by individuals who were blind to condition and had completed a comprehensive standardized training, which included: (a) reading a transcription manual, (b) completing two practice transcripts, and (c) passing a reliability test. The reliability test required 90% agreement against master-coded transcripts for T-unit segmentation, word-for-word accuracy, and SALT codes and conventions. Extensive procedures were used to ensure the quality of transcription (subsequent to coders passing the reliability test), as described in Justice, McGinty, Zucker, Cabell, and Piasta (2013). These included having all transcriptions and parsing of T-units independently checked and corrected, as well as conducting a reliability test with a randomly selected set of videos that were double-transcribed and compared to the original transcriptions.

Conversational parsing

After transcription, each transcript was parsed into semantically meaningful conversations by examining transcripts while watching the corresponding classroom video. A *conversation* occurred when the teachers and children had a back-and-forth exchange on a topic with a minimum of two turns, with a turn defined as a change in the speaker. To be coded as part of the same conversation, utterances were required to have a clear semantic link to a previous utterance (da Rivera, Girolametto, Greenberg, & Weitzman, 2005) and could include talk around any joint activity or an object. Exclusion of teacher or child utterances took place when they were not considered to be part of a conversation, were single turns, were brief interruptions of a primary conversation, or were unintelligible. Also excluded from coding were instances of prolonged teaching or behavior management episodes (i.e., four or more adjacent teacher utterances) semantically unrelated to previous or subsequent child talk. In the rare occurrence that two conversations occurred simultaneously, the conversation initiated first was coded. Approximately 75% of total talk within the 44 coded transcripts was identified as being part of a conversation. In most cases, we dropped the first and last conversations identified in a transcript from analyses if they represented only partial conversations that started prior to transcription or continued after transcription. Given that our analyses depended upon the number of turns in a conversation, we felt that it was unfair to code partial conversations. In most instances, this procedure reduced a transcript by only a handful of utterances.

For the purposes of analyses, *average conversational length* was the mean number of turns across all conversations in each classroom. A *multi-turn conversation* consisted of four or more turns on a topic. A *simple conversation* consisted of two or three turns. We also coded whether a child or teacher initiated a conversational topic.

Teacher elicitations and extensions during conversations

Within each conversation, teacher utterances that were elicitations (i.e., open-ended questions/prompts) and extensions were identified. An open-ended question or prompt was coded when the teacher posed a question or statement in which an adequate response would be more than one word. Open-ended questions typically involved "Wh" – questions and were generally asked when the speaker was trying to elicit talk from the recipient (e.g., "What does the dentist do?"). Open-ended prompts were statements that were also designed to elicit talk from the child (e.g., "Tell me about . . ."). An extension was coded when the teacher produced an utterance that expanded on what a child was saying or doing, provided additional information about an object, action or topic in an effort to continue the conversation, or encouraged the child to think about what he said during the preceding turn. Thus, extensions were only coded when a child conversational turn directly preceded the teacher utterance. An utterance could be coded as

both an elicitation and an extension if the teacher asked an open-ended question following a child turn that simultaneously probed the child's topic (Note that we describe codes here that are relevant to the present study; the full coding scheme is available from the first author).

Five videos (11.4%) were randomly selected for double coding of conversational parsing and teachers' use of the two conversational strategies. For the former, agreement was 89%, based on a criterion of coders agreeing on conversational parsing within a margin of error of two utterances. This is a reasonable margin of error, given that a single speaker could have produced multiple consecutive utterances and that a transcript generally consisted of several hundred utterances. For teachers' use of strategies, agreement calculations were obtained by dividing the number of codable utterances of the secondary coder (the fourth author) by the total number of utterances coded by the primary coder (the first author). The coders agreed on 86% of the codes for elicitations and on 78% of the codes for extensions (overall Kappa = 0.53). Disagreements were resolved through discussion between the coders. Because the codes for extensions fell below 80%, the second coder reviewed all utterances receiving an extension code for accuracy across 100% of transcripts.

Frequency and pattern of teacher–child conversations

On the basis of the coding of conversations described above, two measures representing the nature of teacher–child conversations were calculated. First, *strategy frequency* served as an aggregate of teacher strategy use across conversations, representing the sum of teachers' use of elicitations and extensions. Because these variables were highly correlated ($r = 0.61$, $p < 0.05$) and conceptually overlapping, the sum reflects a global composite representing the frequency of strategy use.

Second, *pattern of strategy use* captured the spacing of teachers' strategy use. Specifically, we calculated how many strategies were used in each conversation and then calculated the variance of these numbers. If the total number of strategies (i.e., frequency) is held constant, then this variance tells us the extent to which the strategies were clustered together, or concentrated, within conversations (when the variance is high) or are evenly distributed throughout the conversations (when the variance is low). A simple hypothetical example illustrating this is presented in Fig. 1. Note that in this example, the frequency remains the same across the two patterns of strategy use, yet more concentrated strategy use is associated with a higher variance. We therefore operationalized spacing as the effect of how the strategies were distributed by examining the predictive ability of the variance of strategies across

conversations after controlling for the overall frequency of these strategies. To examine the frequency and pattern of teacher–child conversations, we focused exclusively on multi-turn conversations (lasting four turns or longer), as these provided the teachers with adequate opportunity to exhibit strategies to elicit and extend child talk and to potentially distribute them in different ways.

Child vocabulary outcomes

A composite score of children's vocabulary (expressive and receptive) was derived using two measures administered to children in the fall and spring of the academic year: the Expressive Vocabulary subtest of the *Clinical Evaluation of Language Fundamentals Preschool-2* (CELF-P:2; Wiig, Secord, & Semel, 2004) and the *Peabody Picture Vocabulary Test-III* (PPVT-III; Dunn & Dunn, 1997). The Expressive Vocabulary subtest was used to measure children's ability to identify and name objects, actions, and people (maximum score = 40). The internal consistency for the Expressive Vocabulary subtest is 0.82 and the test–retest values range from 0.78 to 0.90 (Wiig et al., 2004). The PPVT-III measures receptive vocabulary by presenting children with four illustrations and asking them to choose the one illustration that best matches a spoken target word. Test–retest reliability for this subtest ranges from 0.91 to 0.94 and test developers report an internal consistency of 0.95 (Cronbach's alpha; Dunn & Dunn, 1997). Raw scores were converted into Z-scores and then averaged to create a vocabulary composite.

Our decision to create a composite was based on empirical findings in the literature suggesting that language in the early grades is best considered unidimensional (Tomblin & Zhang, 2006). In addition, the correlation between expressive and receptive vocabulary among children in our sample ($r = 0.75$) suggests the two measures reflect a unitary dimension of skill. Thus, in this paper we used the two measures as a single metric of children's vocabulary ability.

Results

Descriptive findings

Across the 44 teacher–child interactions examined, a total of 1070 conversations were coded, corresponding to about 24 conversations per interaction ($SD = 6.14$; range = 12–38). Half of these conversations ($n = 535$) could be characterized as multi-turn conversations, such that they lasted for at least four or more turns, while the other half could be characterized as simple conversations, lasting for two or three turns only. Across all conversations, the average length of conversations was five turns. Very few conversations lasted for ten or more turns ($n = 106$; 10%). Table 2 presents the means and standard deviations of conversational features based on all teachers in the sample irrespective of condition.

Correlations among conversation variables aggregated to the teacher level are presented in Table 3. As can be seen, teachers who had a higher number of multi-turn conversations also used significantly more elicitations and extensions (Elicitations and extensions were analyzed only in multi-turn conversations.) Teachers with more child-initiated conversations also engaged in significantly more multi-turn conversations. Teachers who asked a larger number of elicitations were also likely to use a larger number of extensions in their multi-turn conversations with children.

PD impacts on classroom conversations

Table 2 also presents means and standard deviations of conversation variables by condition, along with t -tests comparing the raw means. Examining the conversation characteristics of teachers in the control group provides descriptive information about teacher–child conversations under naturalistic conditions.

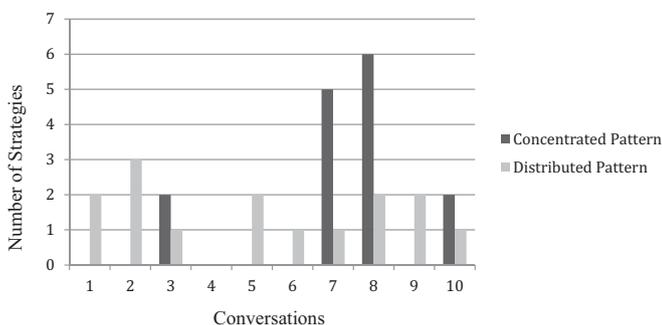


Fig. 1. Example of concentrated versus distributed patterns of strategies to elicit and extend child talk. Note: For teachers with a concentrated pattern of strategy use, there are a total of 15 strategies across 10 conversations, and the variance is 5.17. For teachers with a distributed pattern of strategy use, there are a total of 15 strategies across 10 conversations, and the variance of strategy use is 0.72. Thus, the frequency is identical across the two patterns, but the distribution of the strategies is different.

Table 2
Descriptive statistics and ANCOVA results for treatment and control classrooms.

Conversation variable	All M (SD)	Treatment M (SD)	Control M (SD)	t Test on raw means	F Test on adjusted means	d Calculated from adjusted means
Average conversation length	4.98 (1.35)	5.16 (1.45)	4.80 (1.24)	0.87	0.90	0.30
# Multi-turn conversations	12.16 (4.50)	13.68 (3.27)	10.64 (5.09)	2.36 [*]	5.09 [*]	0.70
# Simple conversations	12.16 (5.71)	12.77 (5.41)	11.55 (6.06)	0.71	0.31	0.17
# Child-initiated conversations	15.75 (6.67)	19.14 (5.50)	12.36 (6.08)	3.88 ^{***}	13.17 ^{**}	1.09
Strategy frequency	14.66 (11.36)	18.23 (13.05)	11.09 (8.20)	2.17 [*]	4.43 [*]	0.64

Note: Adjusted means control for whether teachers held a BA degree and years of experience teaching preschool.

^{*} $p < 0.05$.

^{**} $p < 0.01$.

^{***} $p < 0.001$.

It appears that there is a large amount of natural substantial variability in conversational characteristics. The range of multi-turn conversations among control-group teachers was 4–22, indicating that some teachers engaged children in very few target-length conversations, whereas other teachers commonly engaged children in relatively lengthier conversations (i.e., four or more turns). The range of child-initiated conversations among control-group teachers was 2–24, indicating that some teachers and children engaged in conversations that were dominated by teacher-initiated topics, whereas other teachers regularly followed children's verbal initiations. Importantly, there was also a wide range in the frequency of strategies that teachers used to elicit and extend children's talk (1–30).

We conducted a multivariate analysis of covariance (MANCOVA) to examine whether five conversational measures (average length of conversations, number of multi-turn conversations, number of simple conversations, number of child-initiated conversations, and strategy frequency during multi-turn conversations) differed across intervention conditions. Covariates included whether teachers held a BA degree and years of experience teaching preschool. Results showed a significant multivariate effect for condition, Wilk's $\lambda = 0.603$, $F(5,36) = 4.75$, $p = 0.002$. Results of follow-up analyses of covariance (ANCOVAs) are presented in Table 2. Treatment teachers engaged children in a significantly higher number of multi-turn conversations than control teachers. Treatment teachers also engaged in more child-initiated conversations than control teachers, indicating that treatment teachers followed children's verbal leads more often than control teachers. During multi-turn conversations, treatment teachers also displayed a higher frequency of strategies to elicit and extend child talk than control teachers. There were no significant differences between treatment and control teachers with respect to average length of conversations and number of simple conversations. Effect sizes for significant effects ranged from medium (i.e., number of multi-turn conversations, strategy frequency) to large (i.e., number of child-initiated conversations).

In examining differences between the teachers in the two conditions, we also examined differences in the pattern (i.e., spacing) of strategy use. For this aim, we conducted an ANCOVA separate from our prior statistical models, because we defined concentration as

the variance in strategy use after controlling for strategy frequency, and we did not want to control for frequency when examining the other conversation variables. The ANCOVA for concentration therefore had three covariates: teacher education, teacher years of experience, and strategy frequency. The difference between conditions with regard to pattern of strategy use was not significant, $F(1,39) = 1.82$, $p = 0.19$.

Relation between pattern of conversations and children's vocabulary development

The second aim considered more generally the way in which the pattern of teacher–child conversations, particularly with respect to concentrated and distributed use of strategies, may relate to children's gains in vocabulary over the preschool year (i.e., examining spring vocabulary scores while controlling for fall scores). In addressing this question, we did not differentiate between treatment- and control-group conversations, as teachers in the control condition engaged children in conversations and used a number of the strategies in which we were interested (about 11 per session), albeit at lower rates than the PD teachers. By using all conversations coded in this study, including those occurring in classrooms of teachers trained to facilitate teacher–child conversations and those who were not, we had greater variability in conversational patterns than if we studied only the PD teachers and thus the opportunity to explore how this variance may relate to children's outcomes. It is also important to note that the pattern of strategy use was not a focus of the intervention or training, and it was therefore not surprising that there was no observed impact of the treatment on the pattern of strategy use. Thus we expected the treatment and control groups to be more similar than dissimilar in pattern. While our analyses for this research question controlled for the main effect of condition, we performed an additional exploratory analysis to investigate whether condition moderated the associated between frequency/pattern and children's vocabulary gains. These findings were not significant.

For the present analyses, we examined patterns specific to multi-turn conversations (conversations of at least four turns), as these provide the opportunity to reveal teachers' use of a concentrated versus distributed pattern of strategies. Due to the nested

Table 3
Bivariate correlations among conversation variables.

Conversation variable	1	2	3	4	5	6
1. Average conversation length	–	0.47 ^{**}	–0.69 ^{**}	–0.25	0.65 ^{**}	0.62 ^{**}
2. # Multi-turn conversations		–	–0.29	0.38 [*]	0.39 ^{**}	0.62 ^{**}
3. # Simple conversations			–	0.65 ^{**}	–0.45 ^{**}	–0.38 [*]
4. # Child-initiated conversations				–	–0.14	0.19
5. Frequency: elicitations					–	0.61 ^{**}
6. Frequency: extensions						–

Note that multi-turn conversations are \geq four-turns in length; simple conversations are two or three turns in length

^{*} $p < 0.05$.

^{**} $p < 0.01$.

Table 4
Association between frequency and concentration of language-facilitation strategy use and children's preschool vocabulary development (fixed effects).

Variable	Model 1	Model 2
	Estimate (SE)	Estimate (SE)
Intercept	0.21 (0.06)**	0.18 (0.06)**
Level 1 (child-Level)		
Fall vocabulary	0.90 (0.04)**	0.90 (0.04)**
Age	−0.005 (0.01)	−0.01 (0.01)
Caucasian	0.06 (0.09)	0.06 (0.09)
Maternal education	0.01 (0.04)	0.01 (0.04)
Level 2 (classroom-level)		
Condition	−0.01 (0.07)	0.02 (0.07)
Years of pre-K experience	0.01 (0.01)	0.01 (0.01)
Holds a bachelor's degree	0.01 (0.07)	0.04 (0.07)
Strategy frequency	0.01 (0.003)*	<0.001 (0.004)
Total number of conversations		−0.002 (0.01)
Average conversation length		−0.02 (0.04)
Variance of conversation length		0.003 (0.002)
Variance of strategy use		0.04 (0.02)*

* $p \leq 0.05$.

** $p \leq 0.01$.

structure of the data, we examined a two-level hierarchical linear model using Mplus Version 6.11 software (Muthén & Muthén, 1998). We employed full information maximum likelihood techniques, allowing for parameter estimation based on all available data and assuming that data were missing at random. The intraclass correlation from the unconditional model was 0.09, indicating that some variance lay between classrooms, although the majority of the variance lay within classrooms.

In the first model, we examined strategy frequency as a predictor of children's vocabulary growth over the year. We modeled gains in children's vocabulary over the preschool year by including fall vocabulary scores as a child-level predictor. We also included a series of covariates at both the child and classroom levels. At the child level, covariates included age, ethnicity, and maternal education. Ethnicity was coded as Caucasian (1) or non-Caucasian (0), whereas maternal education was represented by a five-point scale (ranging from 1 = no high school degree to 5 = four-year college degree or more). At the teacher level, covariates included condition in the larger intervention study, teacher education, and years of experience teaching preschool. Teacher education was coded as holding a Bachelor's degree (1) or not (0). Finally, we included strategy frequency, the theoretical variable of interest. All continuous predictors were grand-mean centered unless otherwise noted. The results of the full model are displayed in Table 3. The test statistics show that strategy frequency was significantly related to children's vocabulary development over the preschool year.

In a second model, we estimated the effect of a concentrated versus distributed pattern of strategy use by determining the influence on vocabulary gains of the variance of strategy use across conversations, while controlling for strategy frequency. In these models, a larger variance would indicate that the use of strategies was concentrated in fewer conversations, whereas a smaller variance would indicate that the use of strategies was distributed across the conversations. In addition, we also controlled for the mean length of the conversations and the variance in the length of conversations to ensure that the variance in strategy use is representing the extent to which the strategies are concentrated or distributed across conversations, rather than representing aspects of how utterances were divided into conversations. The test statistics (Table 4) show that variance of strategy use significantly predicted children's vocabulary gains over the academic year; specifically, results indicate a more concentrated use of strategies is associated with greater vocabulary gain compared to a more distributed use.

Discussion

In recent years, there has been increased interest in identifying ways to improve children's language development, particularly vocabulary skills, within preschool classrooms. Some work has relied on correlational methods to explore the relations between specific strategies teachers are observed to use within the classroom and children's vocabulary growth (Girolametto & Weitzman, 2002), whereas other work has used experimental methods to address this aim (Wasik et al., 2006). The present study combined correlational and experimental work to examine how the nature of teacher–child conversations in preschool settings may contribute to vocabulary growth over time. Specifically, we explored the impact of a year-long intervention that trained teachers to serve as conversationally responsive partners with children on the volume and quality of classroom conversational exchanges, and we also examined the extent to which the frequency and pattern of teachers' use of conversational strategies that elicit and extend child talk were related to children's vocabulary gains. A key distinction of this work is that it considered conversations themselves as important units of study, parsing semantically contingent talk into discrete conversational units, and thus helping to improve understanding of the nature of teacher–child conversations within preschool classrooms. We discuss three contributions of this work in turn.

Volume and quality of classroom conversations

The first major contribution of this work is that it provides evidence that the LLLI PD program has positive impacts on the volume and quality of teacher–child conversations in preschool classrooms. Given the current interest in identifying empirically supported practices that may improve children's language growth in preschool settings, an important outcome of this work is that, when considered with our prior impact findings, it identifies LLLI as an effective means for improving teachers' practices. We found that LLLI teachers demonstrated significantly higher quality conversational exchanges with children than control teachers across indicators that have not been examined in previous impact studies of conversational responsiveness. Specifically, LLLI exerted an effect not only on the frequency with which teachers use responsive strategies, as prior work indicates (Girolametto et al., 2003; Pence et al., 2008; Piasta et al., 2012), but also on the quality of classroom conversations themselves, including the amount of multi-turn conversations and number of child-initiated conversations. It is not necessarily surprising that these positive effects were seen, as LLLI teachers were explicitly trained to engage in a minimum of four turns while talking with children and following children's leads was central to the PD program (Weitzman & Greenberg, 2002). An overall premise of the PD provided to teachers is that enhancements to classroom conversations, a proximal goal of the intervention, will lead to distal gains in children's language achievements. Although prior studies of LLLI have examined aspects of teacher talk as an intervention outcome (Girolametto et al., 2003; Piasta et al., 2012), such as their overall level of responsiveness to children, none of this work has focused specifically on the nature of conversations themselves. When viewed in light of our previous reports on this study (Cabell et al., 2011; Piasta et al., 2012), these positive effects on features of conversations may have played a key role in impacting children's language use during these conversations (Piasta et al., 2012); nonetheless, it is important to keep in mind that these improvements in teachers' conversational responsivity were not enough to impact children's distal vocabulary skills (Cabell et al., 2011).

Teachers trained to employ responsive strategies indeed engaged children in a higher number of multi-turn conversations

than control teachers, with a medium to large effect. Involving children in multi-turn conversations (i.e., \geq four turns) is important because it represents a minimum requirement for semantically contingent talk that could serve to increase children's vocabulary learning. As teachers and children engage in a particular topic over successive turns, teachers have the opportunity to expose children to novel and semantically related words that children could meaningfully learn and use.

Another key component of this intervention that we examined in our present analyses was the extent to which teachers allowed children to initiate topics of conversation. Training teachers to follow children's leads was an important focus of the PD; a prior report of this program indicated that teachers more readily followed children's verbal and non-verbal leads when using a global measure (Girolametto et al., 2003). We extended this work to examine whether teachers followed children's topics at the conversation level, with a specific focus on verbal initiation. Indeed, treatment teachers followed children's verbal leads more frequently than control teachers. This indicates that treatment teachers may have been more attuned to children's initiations and may have tried to engage children in back-and-forth conversations on their topics of interest. This style of interaction is associated with children's vocabulary development, as a long history of research in joint attention between parents and children indicates that children acquire more words when parents talk about topics that interest children (Tomasello & Farrar, 1986) and conversely, acquire fewer words when parents ignore children's interests and attempt to redirect their attention (Harris, Golinkoff, & Hirsh-Pasek, 2011; Hollich, Hirsh-Pasek, Tucker, & Golinkoff, 2000).

A related contribution of this work concerns the methodology used to examine teachers' conversational practices. Previous studies of the impacts of LLLI on teachers' use of targeted strategies resulted in mixed findings regarding the effectiveness of this language-intervention program on teachers' conversational behaviors. In our prior work, our research team (Piasta et al., 2012) showed that LLLI teachers increased their use of communication-facilitating strategies (strategies that encourage children to participate in conversations) but not language-developing strategies (strategies that provide advanced linguistic models to children) compared to control teachers. Girolametto et al. (2003) showed that LLLI teachers improved their use of only two out of five targeted communication-facilitating strategies relative to control teachers. Such studies, however, relied on interval-coding schemes (Piasta et al., 2012) or rating scales (Girolametto et al., 2003) to codify teachers' use of targeted strategies. In the present study, we employed a different method, albeit one that was more intensive for capturing potential changes in teacher-child conversations in the classroom: transcribing, parsing, and coding the actual conversations that take place between teachers and children during play. It may be that this more refined approach to capturing teacher-child conversations is more sensitive to capturing intervention effects, and thus provides a more accurate representation of treatment outcomes.

Describing naturalistic classroom conversations

The second major contribution of this work concerns our interest in describing the conversations that take place in preschool classrooms. Several studies in recent years have sought to document the general quality of language-learning supports in preschool classrooms serving at-risk children (Justice, Mashburn, Hamre et al., 2008; LoCasale-Crouch et al., 2007; Pence et al., 2008). For example, Justice and colleagues (2008) documented that language modeling was of high quality in only 4% and low quality in 58% of 135 preschool classrooms serving children living in poverty. The present study provides converging evidence by describing teacher-child interactions across a substantial number

of classrooms with utterances parsed into individual conversations. We found that the overall level of conversational exchanges was low, as half of all conversations, regardless of condition, were very short (i.e., under four turns). Indeed, only 10% of classroom conversations extended to 10 turns, such as the following:

Child: I'm going to make you a birthday cake.

Teacher: A birthday cake?

Child: Yeah, it's your birthday.

Teacher: It's my birthday?

Child: Yes.

Teacher: Happy birthday to me!

Child: You're going to be four.

Teacher: I'm going to be five.

Child: You're going to be 21.

Teacher: 21?

Note the brevity of this exchange in real time, lasting less than 1-min of classroom time. Yet, such "lengthy" conversations were quite infrequent. Despite treatment teachers displaying more multi-turn conversations (four or more turns) than control teachers, the average length of treatment teachers' conversations and the large number of simple conversations (i.e., two or three turns) indicated that teachers who had received PD still had sufficient difficulty engaging children in conversations sustained on particular topics.

Results from the control classrooms specifically can provide a naturalistic lens into teacher-child conversations in preschool classrooms serving children at-risk. Within the control classrooms, we saw considerable variability in how teachers engaged children in conversation, as discussed previously by Dickinson, Darrow, and Tinubu (2008). Control teachers showed substantial individual differences in the extent to which they followed children's leads, engaged in multi-turn conversations, and used strategies to extend children's talk. To illustrate some of these differences, we present two examples that differ with regard to the topic initiator and strategies to extend talk.

Example 1

Child: We can take two.

Teacher: Two rolls of bread. (extension)

Child: Tom get two and I get two.

Teacher: You're dividing them equally, aren't you? (extension)

Example 2

Teacher: You're going to tell me the shapes when I point to them. What shape is that?

Children (in unison): Rectangle.

Teacher: Rectangle. What shape is that?

Children (in unison): Oval.

In the first example, the teacher extends the child's ideas after both utterances, whereas in the second example, the teacher initiates the topic and the children provide a limited response.

While much of our findings were in keeping with prior work done by Dickinson et al. (2008), we found more variability in the extent to which teachers followed children's initiations, perhaps due to our larger sample and different analytic techniques. Nevertheless, our work converges with prior research citing the generally low frequency of the use of important language

development strategies and high frequency of missed opportunities during conversational exchanges. Thus, an important contribution of the present work, with respect to its descriptive examination of teacher–child conversations, is that it highlights the need to continue to explore ways to enhance the quantity and quality of teacher–child conversations in preschool settings.

The relation between teacher strategy use and children's vocabulary development

The third contribution of this work concerns our attention to spacing effects as they might apply to teacher use of strategies in conversations. While we provide evidence that the overall frequency of teacher use of elicitations and extensions is a positive predictor of children's vocabulary growth, we also showed that the spacing patterns of strategy use during multi-turn conversations also relates to vocabulary gains during the preschool year. In fact, findings suggested that concentrated exposure to elicitations and extensions within conversations is associated with better vocabulary learning over time than more distributed exposure. Although much of the prior literature on spacing effects has supported a distributed pattern of learning opportunities relative to massed opportunities (Dempster, 1989), little of this work has examined children's learning within the context of teacher–child conversations. One exception involved a study of five- and six-year-old children who were exposed to recasts during conversations according to a high- versus low-density schedule (Proctor-Williams & Fey, 2007); recasts are similar to the types of strategies examined in this study. Contrary to the researchers' expectations, children showed greater grammatical growth in the low-density condition. This finding runs counter to what we observed, which was that higher concentrations of teacher use of elicitations and extensions within multi-turn conversations predicted children's vocabulary growth over time.

The concentration of teacher use of strategies may reflect qualitatively different types of conversational exchanges among teachers and children than issues of strategy spacing alone. The following is an example of a conversation from a teacher displaying a concentrated pattern of strategy use. It is important to note that this teacher took the opportunity to use the play-dough scenario to engage a group of children in pretend play, which provides an ideal setting for vocabulary learning that extends children's interests and provides children with a context for acquiring semantically related words (Harris et al., 2011).

Child: My dinosaur is bigger than yours.

Teacher: Yeah but mine has got a horn on its head. (extension)

Child: Oh, my gosh.

Child: mine too.

Teacher: Oh no.

Teacher: Mine's got a great big mouth.

Child: Mine too. Mine is bigger than yours. Mine is bigger than yours.

Teacher: Mine has got a big mouth and it's got a sharp horn. (extension)

Teacher: And it's got claws. (extension)

Teacher: He's going to grab yours.

Child: (well this) well this big rock (is) is bigger than your dinosaur.

Teacher: Oh my goodness.

Teacher: Well my dinosaur has a friend that flies.

Teacher: They're going to catch your rock and eat it. (extension)

= children laugh

Child: Well it's too hard to eat.

Teacher: Yeah it is.

Teacher: He broke all his teeth. (extension)

Teacher: Look he doesn't have any teeth.

Teacher: Where did his teeth go? (elicitation)

Child: It's in the rock.

Teacher: They're in the rock now.

Teacher: Yea, you're right.

Teacher: Those are all his teeth. (extension)

Teacher: His teeth broke off in the rock.

Teacher: See the red stuff.

Child: They're bleeding!

Teacher: They're bleeding?

Child: Yeah because they're red.

In contrast, the following is an example from a teacher with a distributed pattern of strategy use:

Teacher: Do you have a real bird at your house?

Child: No XX.

=four children start talking loudly

Teacher: What was that? (elicitation)

Child: Have a girl bird.

Teacher: Does it make pretty noises?

Child: Mhm.

Teacher: Like what? (elicitation)

Child: Tweet, tweet. Like that.

Teacher: Oh. Does it whistle?

Child: It's got a boyfriend. Like that sound.

Teacher: Really?

Child: And it does a whistle.

Teacher: Oh like a XX.

=teacher whistles, other children join.

Notice that in the first example, the teacher–child conversation builds toward something as the teacher uses multiple strategies in a single conversation. In the second example, the teacher uses only a few strategies and they appear to occur incidentally. As examination of these conversations makes clear, it is likely the case that measurement of strategy concentration serves as a proxy for additional dimensions of teacher–child talk, such as the level of cognitive demand required to participate in the conversation. Much of the prior work on spacing effects has involved highly controlled presentations of concentrated versus distributed practice opportunities (Proctor-Williams & Fey, 2007). An important contribution of this present work is that it signals the need to learn more about the nature of teacher–child conversations and the exact mechanisms through which these enhance children's language development. We are left to speculate that concentrated patterns

of elicitations and extensions may seek to foster teacher–child talk that is qualitatively distinct than more diffuse patterns.

Limitations and future directions

Several key limitations of this study warrant note. Although consistent with prior work (Dickinson & Porche, 2011; Dickinson, Hofer, Barnes, & Grifenhagen, 2014), the data examined in this study represented a small amount of time in teachers' classrooms (i.e., 10 min) and were analyzed at only one point in time. We acknowledge that it would be ideal to have a pretest measure to examine the extent to which the intervention had an effect on gains in teacher strategy use. In addition, multiple classroom observations would allow for a more stable estimate of frequency and pattern of strategy use. It is also important to note that the relatively lower inter-rater reliability with regard to extensions suggests that the coding system would benefit from further refinement. While the scope of these data is in keeping with other intervention studies in which transcripts were utilized (Girolametto et al., 2003), we cannot know that the results generalize to conversations across the day and the academic year. Nonetheless, we observed significant differences across conditions and significant associations between features of conversations and children's language gains. Second, the classrooms involved in this study served a select population of children, such that enrollment was targeted to children considered at-risk. It is not known that the effects seen in this study, or the correlational patterns observed in the descriptive analyses, would transfer to other types of settings. Third, we made some assumptions about teacher–child conversation that may require closer analysis; for example, open-ended questions and some types of extensions are generally designed to elicit child talk. Yet, one study has recently reported that teachers often do not allow wait time for children to answer questions and may immediately follow up an open-ended question with a closed question that does not allow for an elaborated response (Wasik & Hindman, 2011b).

The results presented here, as well as the limitations noted previously, identify key areas for which future research is needed. First, we noted that the methods used in this study differed from other studies in terms of codifying PD impacts on the nature of teacher talk in the classroom. These methodological differences may lead to the mixed findings in the literature on PD impacts. Whereas prior work has used rating scales and interval schemes to document changes in teachers' practices (Girolametto et al., 2003; Piasta et al., 2012), the present work transcribed, parsed, and coded teacher–child conversations. Many language-focused interventions, beyond that discussed here (i.e., LLI), have as a principle goal an interest in enhancing teacher–child conversations (Pence et al., 2008; Pianta, Mashburn, Downer, Hamre, & Justice, 2008; Powell et al., 2010; Wasik et al., 2006). Future research should seek to identify the optimal methods for examining the extent to which such interventions have impacts on the key proximal outcome of teacher–child conversations. Second, the results presented here suggested that the pattern of teacher use of elicitations and extensions may be influential to children's vocabulary growth. However, this finding was correlational and not the result of planned comparisons of strategy patterns. Future research should strive to investigate, using causally interpretable research designs, whether spacing of conversational strategies may indeed influence children's language skills.

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