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Inferential talk during teacher–child interactions in small-group play

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ABSTRACT

This study examined teachers' questions and children's responses during a play-based activity implemented in small groups within preschool classrooms. The first aim of this study was to describe teachers' questions in terms of four levels of abstraction (i.e., a continuum of literal to inferential questions) and children's responses to these questions. The second aim was to examine the relations between teachers' questions and children's responses using sequential analyses, to include children's level of abstraction and mean length of utterance (MLU). Participants were 39 teachers and up to six children from their preschool classroom. We found that teachers' questions made up an average of 25% of their talk to children during play, and were relatively balanced between literal and inferential questions. Furthermore, significant sequential associations were found between the level of abstraction of teachers' questions and the level of abstraction of children's responses (e.g., teachers' inferential questions tended to elicit children's inferential responses). Finally, we found that teachers' inferential questions were not related to children's MLU; that is, teachers' more abstract questions did not elicit longer utterances from children. These findings suggest that play is a valuable context in which teachers may promote children's use of inferential language.

Researchers, teachers, and policy makers are increasingly invested in ensuring that all children arrive to kindergarten ready to learn, particularly with respect to their proficiency in spoken language and early literacy skills. Interest is specifically directed toward children from disadvantaged backgrounds who face risks for arriving to school lagging behind their middle-income peers in these important domains (Justice, Bowles, Pence Turnbull, & Skibbe, 2009). Although instruction in basic skills such as alphabet knowledge is clearly essential for enhancing children's school readiness and subsequent success in school, there is increased interest in identifying ways to improve young children's higher-level language abilities, such as inferencing. Researchers argue that inferencing, particularly as it occurs at a metalinguistic level (e.g., predicting what happens next in a story), is a critical dimension of skilled reading and one that differentiates good and poor readers with respect to comprehension (Cain & Oakhill, 1999; Cain, Oakhill, Barnes, & Bryant, 2001). The goal of this study was to examine preschoolers' participation in exchanges with their teachers involving inferential talk, including how teachers' use of inferential talk might scaffold children's own expression of higher-level talk.

1. Inferential talk during adult–child interactions

Inferential talk in young children, which refers generally to talk that goes beyond the here and now, has most often been studied in the context of adult–child book reading (e.g., Hammett, van Kleeck, & Huberty, 2003; Price, van Kleeck, & Huberty, 2009). Exposure to inferential talk plays an important facilitating role in children's later language development. Researchers have found that mothers' and teachers' use of more abstract, inferential language during shared book reading with young children predicts children's future story comprehension (Dickinson & Smith, 1994; Haden, Reese, & Fivush, 1996; Reese, 1995; Teale & Martinez, 1996); vocabulary (Dickinson & Porche, 2011; Hindman, Connor, Jewkes, & Morrison, 2008; Leseman & de Jong, 1998); abstract language (van Kleeck, Gillam, Hamilton, & McGrath, 1997); and intelligence (Sigel, 1993), with effects as long-lasting as fourth grade (Dickinson & Porche, 2011). Additionally, researchers have shown experimentally that training adults to use inferential language with children results in young children producing significantly more inferential talk than controls (McKeown & Beck, 2003; Peterson, Jesso, & McCabe, 1999; van Kleeck, Vander Woude, & Hammett, 2006).

Adult–child play routines also may provide a salient context for studying children's engagement in and exposure to inferential talk, given that a considerable amount of children's time within preschool classrooms is spent in play (e.g., Smith & Dickinson, 1994). Pretend play, in particular, may invite adult–child

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conversations that are inferential in nature, although this has seldom been studied. Thus, the primary aim of this study was to describe teachers' talk while interacting with small groups of children during play routines, specifically the extent to which this talk was inferential in nature, and to determine whether teachers' inferential talk evoked children's use of inferential language. Some research suggests that book-reading interactions might entice more inferential talk from teachers than play-based interactions (Massey, Pence, Justice, & Bowles, 2008). However, that work examined generic forms of play that naturally occurred in classroom activities, and did not look at inferential talk situated within pretend play. Some types of play (e.g., motor and expressive play) might not cultivate high levels of inferential talk, whereas other types of play (symbolic and dramatic play, which we collectively refer to as pretend play) might entice both teachers and children to produce inferential talk at relatively high levels.

2. Literal versus inferential language

The language that an individual produces (or comprehends) can be situated along a continuum differentiating that which is more literal/perceptual in nature (e.g., labeling or discussing items present in the immediate environment) from that which is more inferential/abstract (e.g., predicting future events, hypothesizing, and reasoning about causal relationships; van Kleeck et al., 1997). Inferential or abstract language is considered largely synonymous with such terms as decontextualized language (e.g., Curenton & Justice, 2004), displacement (e.g., Adamson & Bakeman, 2006), non-immediate talk (e.g., Baker, Mackler, Sonnenschein, & Serpell, 2001), cognitively challenging talk (Massey et al., 2008), or higher-level talk (Hogan, Bridges, Justice, & Cain, 2011). Measures of these higher-level language skills begin to explain significant amounts of unique variance around age 4 (Rowe, 2012) and continue to account for 8- to 11-year-old children's reading comprehension, even when controlling for lower-level (more basic) language skills, working memory, and word-reading abilities (Cain, Oakhill, & Bryant, 2004).

For young children who are not yet readers, their inferencing abilities are often conceptualized with respect to their participation in conversations with adults. Blank, Rose, and Berlin (1978a) represented the literal-to-inferential continuum as comprising four levels of increasingly inferential (or abstract) talk, and this scheme has been adopted in a number of subsequent works that examined adult–child interactions (e.g., Hammett et al., 2003; Sorsby & Martlew, 1991; van Kleeck et al., 1997; Zucker, Justice, Piasta, & Kaderavek, 2010). Based on their initial conceptualizations, Level 1 is referred to as matching perception (e.g., talk involves labeling or counting objects, as in "This is a dog.") whereas Level 2 is referred to as the selective analysis of perception (e.g., talk involves describing perceptual qualities, as in "This dog is very small."). These two levels are considered to involve literal talk, as they focus on immediate aspects of the environment and involve little or no inferring from participants in the exchange. At a more inferential level, Level 3 refers to inferences about perception (e.g., explaining a character's point of view, as in "Why do you think the dog looks happy?") and Level 4 refers to reasoning about perception (e.g., predicting a future event, as in "What do you think the dog will do next?").

3. The importance of moment-by-moment interactions

The assumption within the literature on adult–child book-reading is that through adult–child interactions, adults can model and scaffold the use of inferential talk and, with time, children will internalize these skills and use them independently, as shown in their later performance on language tasks (e.g., van Kleeck et al., 1997). However, these types of studies do not specify the exact mechanism that is taking place within these conversations that may provoke children's own inferential language use. We have proposed elsewhere (see Zucker et al., 2010) that an important mechanism for building later inferential language skill is that adults' use of higher-level talk directly evokes children' immediate use of higher-level talk which, in time, results in advances to these skills. Sequential analysis permits researchers to examine the immediate effects of adult talk on children's subsequent utterance quality or complexity. Sequential analysis is used to determine whether certain sequences of adult–child utterances occur more frequently than would be expected by chance (Bakeman & Gottman, 1997; Bakeman & Quera, 1995). Using this approach, researchers have measured adult–child language across the continuum of the four levels of abstraction to determine how the level of abstraction in utterances by a parent or teacher influences the subsequent utterances of the child (Danis, Bernard, & Leproux, 2000; Zucker et al., 2010). Sequential analysis is a valuable way to examine adult–child inferential talk because it may provide an explanation of how young children internalize the use of such higher-level language within contextualized interaction; that is, we might surmise that adult use of an inferentially challenging question evokes a child's participation in an inferentially demanding response.

Using sequential analysis, researchers have shown that parents' and teachers' utterances during shared book reading tend to match the level of abstraction contained in young children's responses. Zucker et al. (2010) found significant alignment between the inferential level of teachers' questions and preschoolers' responses during large-group reading. Additionally, when teachers in this study (Zucker et al., 2010) asked questions at the highest level of abstraction, children were more likely to respond with longer utterances (i.e., 3 or more morphemes) than with shorter utterances. Danis et al. (2000) found similar alignment between parents' and children's use of the four levels of abstraction in book-reading interactions using sequential analyses.

4. Pretend play as a context for examining inferential talk

Despite the overwhelming emphasis on book-reading activities as a context to study children's exposure to inferential talk in preschool settings, children in preschool classrooms spend relatively little time in book-sharing experiences. In a sample of 156 preschoolers, Connor, Morrison, and Slominski (2006) found that teachers spent an average of 4 min per day reading books. In a sample of 2751 preschoolers, Chien et al. (2010) found that children spent 12% of the day in literacy activities. In contrast, children spent the largest proportion of their day (30%) in free-choice activities, which included a variety of play routines embedded in structured activities and unstructured center times. In the present study, our goal was to examine inferential talk within a structured play-based activity, to determine not only how much inferential talk occurs but also to determine whether children tend to produce inferential talk in response to teachers' inferential questions.

We might speculate that teachers' expression of inferential talk (i.e., Levels 3 and 4) would be significantly aligned with the inferential level of child responses. In support of this speculation, researchers have found significant alignment between mothers and young children during play in terms of their level of abstraction (e.g., literal play versus object substitution; Damast, Tamis-LeMonda, & Bornstein, 1996; Katz, 2001; Tamis-LeMonda & Bornstein, 1991). However, such studies did not look at alignment between abstraction levels of parent and child *talk*. To our knowledge, researchers have not directly examined linkages

between adult–child inferential talk during play, although a few studies suggest that children's language may be enhanced through play-based interactions in the classroom (e.g., Pellegrini & Galda, 1982; Saltz, Dixon, & Johnson, 1977). Additionally, only one study has explicitly examined differing levels of abstraction in adult–child play (Sorsby & Martlew, 1991); however, analyses focused on differences between book and play-doh contexts rather than on relations between mothers' and children's talk within a context.

5. The current study

The purpose of this study was to expand investigation of children's experiences with inferential talk in the early childhood classroom in the context of pretend play. Specifically, we examined teachers' and children's use of inferential talk in a small-group play context in which the teacher and four to six children engaged with play materials (e.g., play-doh, a roller, a knife) inviting pretend play (e.g., making an animal). The play-doh activity was chosen because previous researchers have found this activity to be a useful way of eliciting teacher conversations with young children (de Rivera, Girolametto, Greenberg, & Weitzman, 2005; Girolametto, Hoaken, Weitzman, & van Lieshout, 2000; Girolametto & Weitzman, 2002). For example, Girolametto and Weitzman (2002) found that teachers' use of interaction-promoting strategies, child-oriented strategies, and language-modeling strategies (combined across book and play contexts) with preschoolers were all significantly related to children's number of utterances, length of utterance, and number of different words. However, Girolametto and Weitzman (2002) did not examine teachers' talk in terms of their use of inferences to guide the play-doh activity. We hypothesized that in this type of play-based interaction that teachers' use of inferential talk would occur at rates similar to that of shared-reading interactions (Zucker et al., 2010), in which about one-half of pre-kindergarten teachers' questions are inferential in nature.

Similar to prior studies of teacher–child interactions in the preschool classroom, we specifically examined teachers' questions with respect to their inferential demand (Massey et al., 2008; Zucker et al., 2010). The focus on teacher questions is important for several reasons. First, questions are one of the most commonly used discourse types in early childhood classrooms; Massey et al. (2008) found that one-third of the utterances produced by teachers serving low-income 4-year-olds were questions. Additionally, Zucker et al. (2010) found that about one-half of teachers' questions during shared book reading were at an inferential level. Second, questions, by their nature, are designed to elicit a response from the recipient; adult questions during book reading and play elicit more verbalizations from children than do other speech acts, such as statements (e.g., Girolametto & Weitzman, 2002; Girolametto, Weitzman, van Lieshout, & Duff, 2000; Sénéchal, Cornell, & Broda, 1995). For example, Justice, Weber, Ezell, & Bakeman (2002) examined parent–child book-reading interactions and found that preschoolers responded to 87% of parents' prompts, whereas children responded to only 20% of parents' comments.

This study was conducted as an extension of our previous study of shared reading (Zucker et al., 2010), by adopting the same coding scheme and method of analysis to examine teachers' questions and children's responses within the context of small-group play and within a unique sample. The aims were twofold: (1) To describe preschool teachers' use of inferential questions and children's responses during small group play, and (2) To examine the relations between teachers' use of inferential questions during play and child responses, including the level of abstraction of child responses and their complexity in terms of MLU.

6. Method

6.1. Participants

The participants in this study were 39 teachers, who were observed interacting with a teacher-selected subset of 3- to 5-year-old children in their classrooms. The teachers were drawn from a larger cohort of teachers who participated in a longitudinal study of classroom practices. For the present study, which involved transcription and analysis of a videotaped interaction submitted by the teachers midway through the academic year, we include only those teachers for whom this video was available; this represented about 80% of the teachers in the full sample. The 39 teachers in the present study were lead teachers in their classrooms, all of which targeted enrollment to children exhibiting certain risk factors (typically low-income status). The majority of the classrooms were affiliated with Head Start (78%) although some were supported through the state pre-kindergarten initiative (22%). The teachers were primarily female (97%), and reported an average of 11.5 years of teaching experience ($SD = 6.7$, range 0–25 years). Their highest education level varied: 17% had a master's degree, 37% had a 4-year bachelor degree and 43% had a 2-year Associate's Degree; 1 teacher had no degree beyond the high school diploma. In terms of race, 69% of the teachers were Caucasian, 23% were African American, 6% were multi-racial, and 3% were Native American. The teachers varied in their experience working in preschool settings, with one-third of the sample (31%) reporting the year of participation to be their first or second year teaching preschool; however, the median number of years of experience teaching preschool was 9 ($M = 10.2$, $SD = 7$).

For the purpose of this study, we examined teachers' interactions during small-group play-based interactions conducted within their classrooms midway through the academic year. Teachers were asked to select a small group of children (we recommended four to six) from their classrooms for participation in the videotaped activity. Individual-level data for the children involved in these specific interactions was not collected during the conduct of the study (i.e., teachers selected children to play with and recorded this play, but the researchers did not have the identity of these children). However, as part of the larger study in which teachers were participating, the research team randomly selected a subset of five to eight children from each classroom (the exact number was based on the number of caregiver consents received) and conducted an extensive individually administered battery in the fall of the year. Information on these children, which represents about 40% of the children enrolled in the teachers' classroom, may be helpful for understanding the characteristics of the children who were studied in the present work, although these may not be the same children engaged in the teacher-play interactions of the present study.

Specifically, in the larger study, data on 330 children in 49 classrooms were collected. The majority of children (71%) resided in a household with an annual income less than 25,000; 24% resided in households with an annual income between US$ 25,000 and 50,000, and 5% resided in households earning more than US$ 50,000. Children's ages at the beginning of the academic year ranged from 40 to 66 months ($M = 48$, $SD = 5.4$ months). More than half of the children were male (54%). Forty percent of children were Caucasian, 42% were African-American, 9% were Hispanic/Spanish/Latino, 1% was Asian and 8% were multiracial. With respect to the children's language abilities, they were administered a standardized language assessment in the fall of the year (Comprehensive Evaluation of Language Fundamentals—Preschool; Wiig, Secord, & Semel, 2004). The average language ability composite was 83.6, which is about −1 standard deviation (SD) of the normative mean; 64% of children performed below the 25th percentile on the measure. Thus, as a group, the children in the study's classrooms had language scores

lagging behind age-based norms, as would be consistent with the targeted-enrollment nature of the participating classrooms.

6.2. General procedure and materials

Teachers were recruited into this study prior to the fall of the academic year. Teachers were randomly assigned into two conditions, with approximately half implementing their business-as-usual (BAU) instructional practices and the other receiving professional development (PD) related to language practices (i.e., increased turn taking, improvements in following children's lead). Prior research showed there to be limited effects of the PD on children's language growth over the academic year (Cabell et al., 2011), and the PD was not designed to affect teachers' use of inferential talk. A full discussion of this intervention, which involved providing PD to teachers on how to communicate more responsively to children, is available in a prior report (Cabell et al., 2011). In the present study, we did not differentiate between teachers as a function of their assignment to the BAU or the PD condition and rather pooled the data for all teachers irrespective of study assignment. This decision was further substantiated through a comparison of characteristics of teachers' talk to children during the play-based sessions examined in the present work. Specifically, a comparison of the BAU and PD teachers showed no significant differences in the total number of utterances teachers produced, $F(1, 37) = .002$, $p = .961$, the total number of words teachers produced, $F(1,37) = .13$, $p = .910$, and the average length of teachers' utterances in morphemes, $F(1,37) = .096$, $p = .759$.

As part of their involvement in the larger study, the teachers were asked to record their classroom instruction every two weeks for a 20-min duration over a 30-week period. Teachers thus submitted a total of 15 videos over an academic year. Prior to each video capture, teachers received specific instructions in terms of specific classroom activities to capture, which included large-group teacher-led instructional activities as well as small-group teacher–child activities. Teachers were provided all materials for completing the video on the specified schedule, including a digital video camera, recording media, and stamped addressed mailers for submitting the media to research staff upon completion. In addition, teachers were provided with materials necessary to execute the instructional activities requested for each session (e.g., play-doh, book).

The videotape analyzed in the present study was collected midway through the academic year, representing approximately the 15th week of instruction. This video was selected for intense study in the present work as it was midway through the academic year and thus was considered to be more representative of teacher–child interactions than in the fall of the year (when teachers and children are still learning about one another and in the spring, when a variety of end-of-year activities are taking place and kindergarten transition is underway). For this video, teachers were asked to engage in a small-group play activity, involving a teacher-selected group of up to six children from their classroom. The teachers were provided a set of materials to use in this activity, which featured play-doh and related props (e.g., plastic knives for cutting the doh). Teachers were asked to play with the children and interact with them for a 20-min duration. Teachers were not given any specific information on how to select children for this session and they were not questioned as to how their selections were made.

Videotapes submitted by teachers ($n = 39$) were transcribed within a laboratory setting following protocols used across all studies generated by this research team (e.g., Justice, Mashburn, Pence, & Wiggins, 2008b; Massey et al., 2008). Teacher's level of education and years of experience were not significantly related to whether or not they submitted the focal video for this study (education, $t(45) = -.36$, $p = .72$; experience, $t(45) = .82$, $p = .42$). A continuous 10-min segment, representing a medial 10-min cut from each teacher's video, was transcribed verbatim using the Systematic Analysis of Language Transcripts software (SALT; Version 9; Miller, 2006). Transcription of a medial cut removed from analysis the teachers' orientation of children to the activity (e.g., introducing the activity to children, situating children so they can all be seen on video) and the closure to the activity (e.g., when teachers and children were cleaning up). Selecting a 10-min segment, rather than transcribing the entire video, also controlled variability across sessions in terms of length, given that some teachers did not fill the requested 20-min time of interaction. We modeled our transcription/segment selection on work by Girolametto and Weitzman (2002), who studied relations between preschool teachers' conversational responsiveness and children's language productivity in play-doh based teacher–child interactions.

During transcription, parsing occurred at the level of the T-unit. Each T-unit, consisting of no more than two independent clauses with dependent clauses or attached phrases, was entered as a separate line in the SALT software. Parsing at the T-unit, which uses syntactic information as a means to parse running speech, is slightly different than parsing at the utterance level, which relies more on subjective attention to pauses and pitch changes as a means to assess utterance boundaries. We parsed based on T-units because it is more objective and thus reliably implemented across transcripts. Transcription also adhered to SALT conventions for marking morphemes, addressing fillers and mazes, and accounting for unintelligible utterances and interruptions (see Miller, 2006, for complete overview of the conventions). Transcription was conducted by research assistants who had completed a multi-step tutorial, practice transcriptions, and a reliability test. The latter involved achieving 90% agreement against master-coded transcripts for four consecutively coded transcripts; agreement was calculated separately for accuracy of (1) T-unit segmentation, (2) word-for-word transcription accuracy, and (3) SALT conventions and codes. Coding was thus completed by persons who had achieved a reliability agreement to master-coded transcripts that equaled or exceeded 90%.

6.3. Coding of inferential talk

For the purposes of this study, each transcript was coded using a coding scheme that we developed for a prior study of teachers' inferential talk during shared book-reading interactions (Zucker et al., 2010). That coding scheme was designed to (a) differentiate teachers' questions from other types of utterances, and (b) identify the level of abstraction (along a continuum of literal to inferential talk) for all teacher questions and subsequent child utterances. Note that the coding scheme involved three different sets of codes applied, and these were applied in a sequential manner as the second codes were dependent on what was coded in the first set and the third dependent on what was coded in the second set. Note that the prior study in which the scheme was used involved a different set of preschool teachers who were observed reading books to their students; the application of this coding scheme in the present study involves a unique set of preschool teachers involved in a separate type of classroom activity (engaging in small-group play).

The first set of codes was used to identify teachers' questions and differentiate these from other types of utterances (i.e., comments, requests). To do this, a mutually exclusive and exhaustive (MEE) set of three codes was applied to each teacher utterance in each transcript. Teacher questions were coded as either Teacher Question (TQ; e.g., "What are you going to do?") or Managerial Question (MQ; e.g., "Do you need to go to the bathroom?"). The remaining teacher utterances were coded as Teacher Other (TO; e.g., comments, fillers, non-question directives). Since

Table 1
Summary of sequential analysis codes and definitions.

Description	Examples of Teacher Questions	Examples of Children's Utterances
Level of abstraction for teacher questions/child utterances		
[TQ1/CL1]—Literal utterance requires matching perception		
• Labeling objects	What is that?	Look what I made, an egg.
• Locating objects	Where's the knife?	Look what I did.
• Noticing objects	Did you see Mary's snowman?	I made a snake.
• Counting concrete objects		I want to use this color.
• A request for help with materials		
[TQ2/CL2]—Literal utterance requires selective analysis/integration of perception		
• Describing object characteristics—perceptual qualities	How does it feel?	This is a cookie made out of red cookie.
• Imitating	What color is your cookie?	It melted.
• Recalling actions/events/scene	Can you get that rolled up?	I got a yellow one.
• Giving simple directions up to 2 steps (e.g., sit down, pick it up; sit down and roll it out)		Frosty is flying.
• Possession		
[TQ3/CL3]—Inferential utterance requires reordering/inferring about perception		
• Sequence of past or future events	Is an egg really round?	It looks like a potato.
• Point of view/cognition/feelings	Are the snowman balls the same size?	I want to make a green snowball.
• Judgment		
• Inference	Is that going to be your big one or your little one?	I want a button on it.
• Compare similarities/differences		
• Summarize/synthesize information	What could we use the black for on a snowman?	I'll make a mouth.
• Generalize		
• Text-to-life connection/comparison	What goes around his neck?	
[TQ4/CL4]—Inferential utterance requires reasoning about perception		
• Define word meaning	What would make the snowman melt?	Yeah, we need to mix them all together to make green.
• Define the function/purpose of an object or print unit		
• Predict/hypothesize	What happens to water when you put it outside and it's cold?	I don't like stars because I don't even know how to make them.
• Justify or explain a prediction, judgment, or inference		
• Explain conditions that cause alternate outcomes	How would I get that color?	Well if you fall I'll save you because all I have to do is jump.
	What else could I use this for?	
• Identify causes of occurrence/event		
• Identify direct or indirect effects		
• Distinguish between fact and fiction		
• Formulate a solution		
• Identify essential/non-essential characteristics		

managerial questions (MQ) tend to elicit a restricted response from children, only teacher questions (TQ), which included all interrogative forms (e.g., tag questions, yes/no questions, wh-questions, intonation questions) were subsequently coded for level.

Following identification of teacher questions (TQ), each TQ was coded for the level of abstraction/complexity, using categories from Blank, Rose, and Berlin (1978b) and van Kleeck et al. (2006). These four codes were mutually exclusive and exhaustive, and examples appear in Table 1. The four codes represent a continuum of literal to inferential talk, including teachers' literal questions (Levels 1 and 2; TQ1, TQ2) and teachers' inferential questions (Levels 3 and 4; TQ3, TQ4). Each T-unit was coded independently. For example, if a teacher asked multiple questions in one turn (and each question was considered a separate T-unit), each question was coded separately. Thus, teacher questions that did not allow time for a response were also coded along the literal-to-inferential continuum. Teacher and child utterances were also coded in terms of the four levels of abstraction if they were indirectly related to the play activity (e.g., comparison of an object or action made with play-doh to something previously learned in the classroom or a reference to a personal preference, such as liking a particular color). Note that children's utterances were not coded for level of abstraction or complexity if they were abandoned or interrupted, were unintelligible, or were behavioral utterances (coded as Non-meaningful below). Children's utterances were also not coded for level of abstraction or complexity of production if they comprised a simple yes/no response as there was not enough content available in these utterances alone to determine a level of abstraction (coded as Low below).

Once all TQs were coded into one of the four levels of abstraction, all child utterances were coded to capture level of abstraction and the complexity of production. In terms of level of abstraction, each child response was coded using the same scheme applied to teacher questions (i.e., Level 1, 2, 3, or 4; see Table 1). For the complexity of production, children's utterances were coded into one of four categories: (a) Non-meaningful (i.e., utterances that were unintelligible or contained only filler words), (b) Low (i.e., utterances that contained two or fewer morphemes), (c) High (i.e., utterances that were three morphemes or longer), or (d) No Opportunity (i.e., the teacher did not wait for children to respond, pausing for less than 2 s before taking the next conversational turn). In general, we presumed that any child utterance that was two or fewer utterances in length would provide only limited contribution to the conversation, as it would only be a one (e.g., Dog; Green) or two-word utterance (e.g., That one; My turn).

Since child utterances and responses to teachers were produced within the context of small-group play, sometimes a teacher question elicited responses from multiple children. When this occurred, the teacher question was only transcribed and coded once; the child responses were represented on the transcripts sequentially (e.g., one child response followed by another response and so forth). In such occasions, the highest level of production and abstraction any child gave following a teacher question was used for analyses.

To conduct this training, two doctoral students (the fourth author and a peer) were trained to 90% accuracy on three master-coded transcripts. Subsequently, these two coders completed all coding. To ensure the accuracy of the scheme, 10% of the transcripts

Table 2
Descriptive Statistics.

	M	*SD*	Range	Rate/min.	Frequency	Proportion
Teacher Codes						
Level-1 Question	9.77	9.35	0–43	.97	381	7.31%
Level-2 Question	7.21	5.09	1–23	.72	281	5.39%
Level-3 Question	12.69	8.85	0–41	1.26	495	9.50%
Level-4 Question	3.26	4.39	0–20	.32	127	2.44%
Managerial Question	10.69	8.56	0–32	1.06	417	8.01%
Other (e.g., comments)	89.95	28.05	45–174	8.95	3508	67.35%
Totals				*13.30*	*5209*	*100%*
Child Codes						
Non-meaningful	3.49	4.73	0–28	.35	136	3.75%
Low (MLU 1 or 2)	34.00	14.29	14–80	3.38	1326	36.60%
High (MLU $\geq$ 3)	55.41	22.33	16–103	5.52	2161	59.65%
Totals				*9.25*	*3623*	*100%*
No Opportunity	8.03	6.78	0–29	.80	313	n/a
No Level (e.g., yes/no)	15.51	7.86	3–35	1.54	605	16.70%
Level-1 Utterance	30.51	17.23	6–96	3.04	1190	32.85%
Level-2 Utterance	16.69	6.99	3–29	1.66	651	17.97%
Level-3 Utterance	26.00	15.86	6–89	2.59	1014	27.99%
Level-4 Utterance	4.18	3.96	0–18	.42	163	4.50%
Totals				*9.25*	*3623*	*100%*

were randomly selected and double-coded for all codes discussed above. For teacher question identification, event alignment kappa, which is the kappa value used for sequential analysis, was .90 (exact agreement = 93%). For the next level of coding, teacher question level of abstraction, kappa was .60 (exact agreement = 71%); kappa for child response level of abstraction was .68 (exact agreement = 76%). Finally, for child response complexity, kappa was .83 (exact agreement = 88%). These kappa values are considered moderate to perfect (Bakeman & Quera, 2011).

7. Results

7.1. Data analysis

In this study, we used sequential analytic methods to study the types of questions that teachers pose during small-group play activities and children's immediately following responses. Our coding produced event-sequential data that included sequences of teachers' questions and all of children's utterances. These data were pooled across teachers and entered into a generalized sequential querir (GSEQ; Bakeman & Quera, 1995) and analyzed with a lag-1 sequential method. To identify probable event sequences, we examined transitional probabilities and two sequential analysis test statistics. The first test statistic is the adjusted residual that indicates whether sequential probabilities are more or less likely than expected by chance and the second effect size statistic is Yule's *Q* (Bakeman & Gottman, 1997). Adjusted residuals are interpreted like a *z*-score and entail the assumption that sequential pairs of behaviors occurred independently; however, the teacher–child interactions nested within each of the 39 observations are not independent. This led us to consider a second statistic that is more robust to this type of non-independent event sequence—the Yule's *Q* effect size (Yoder & Feurer, 2000). To interpret z scores, the alpha level was set at .01; therefore *z* scores of $\pm$2.58 were considered significant. To interpret Yule's *Q*, possible values range from $-$1.0 to +1.0, with values closer to zero indicating no meaningful relation, much like a correlation coefficient. Guidelines for understanding the magnitude of effect indicated by Yule's *Q* are as follows: 0 to $\pm$.29 negligible; $\pm$.30 to $\pm$.49 moderate; $\pm$.50 to $\pm$.69 substantial; and $\pm$.70 very strong (Bernard, 2000).

7.2. Characteristics of teacher–child talk during play

Before focusing on questioning sequences, our first research aim was to characterize the types of utterances teachers and children used during small-group activities (see Table 2). We coded 5209 teacher utterances and 3623 child utterances. In a play session, teachers produced significantly more utterances (M = 133.56, SD = 39.15) on average than children (M = 92.90, SD = 30.20), $t(38) = -6.98$, $p < .001$. Approximately two thirds of teachers' utterances were comments (67%) and managerial questions accounted for 8% of teacher utterances. After excluding comments and managerial questions, teachers' questions (25% of all utterances) were relatively balanced between literal questions (52%) and inferential questions (48%). Note that the initial aim of this work was to examine the extent to which teachers produced inferential talk, specifically questions at the higher levels of the abstraction continuum, in a play-based context. We anticipated that about one-half of teachers' questions would be inferential in nature; indeed, this is precisely what was shown by these initial descriptive data.

With respect to children's talk, the majority of children's utterances were at the literal level (51%) and approximately one-third were at the inferential level. The mean number of literal utterances (M = 47.21, SD = 19.12) per play session was significantly more than the number of inferential utterances (M = 30.18, SD = 17.19), $t(38) = 4.11$, $p < .001$. The majority of children's utterances were coded as High-production utterances (i.e., 3 or more morphemes; 60%), whereas 37% were Low-production utterances (i.e., 1 or 2 morphemes). The average play session contained 55.41 (SD = 22.33) High-production utterances and 34.00 (SD = 14.29) Low-production utterances, which was a significant difference, $t(38) = -5.76$, $p < .001$. Children also used many "Yes/No" utterances (17%) that were coded as No Level of Abstraction because the level could not be inferred independent of surrounding utterances. About 29% of children's utterances followed a teacher question and 39% followed teacher comments, whereas 32% followed another child utterance.

To further characterize patterns of classroom dialogue, we also examined whether there were differences in teachers' or children's total amount of inferential talk based on treatment group. We found no significant difference in teachers' use of inferential questions between teachers in the PD (i.e., intervention) and BAU (i.e., control)

Table 3
Lag 1 Analysis with Teacher Question as Given and Child Inferential Response as Target.

	No Level	Level 1 Utterance	Level 2 Utterance	Level 3 Utterance	Level 4 Utterance	Totals
Level 1 Question	48/61 (−2.34*/−.21)	129/55 (13.41**/.81)	24/33 (−2.05*/−.24)	17/61 (−7.71**/−.73)	8/15 (−2.24∼*/−.40)	226
Level 2 Question	50/49 (.21/.02)	32/44 (−2.31*/−.24)	77/27 (11.94**/.81)	20/49 (−5.42**/−.57)	1/12 (−3.73∼**/−.89)	180
Level 3 Question	104/95 (1.45/.11)	31/85 (−8.77**/−.70)	19/52 (−6.40**/−.65)	185/94 (14.25**/.84)	10/23 (−3.76∼**/−.56)	349
Level 4 Question	28/25 (.75/.09)	14/22 (−2.16*/−.31)	5/14 (−2.67*/−.53)	7/25 (−4.44**/−.67)	38/6 (14.02∼**/.93)	92
Totals	230	206	125	229	57	847

Observed frequency/expected frequency.
(Adjusted residuals [significant results $^{*}p < .05$; $^{**}p < .01$, ∼ approximation, lacks normality]/mean Yule's *Q*).

group, $t(38) = .88$, $p = .38$. However, we did find a significant difference in children's use of inferential responses, with children in the intervention group providing significantly more inferential level utterances than children in the control group, $t(247) = 7.47$, $p < .001$. We also examined the correlations among teachers' years of education and teaching experience and teachers' and children's use of inferences. Teachers' number of inferential questions was significantly related to their level of education, $r(38) = .34$, $p < .05$, but not to years of teaching experience, $r(38) = .11$, $p = .53$. Children's number of inferential responses was unrelated to teachers' education, $r(38) = .10$, $p = .56$ or years of teaching experience, $r(38) = .09$, $p = .61$.

7.3. Do teachers' inferential questions elicit inferential child responses?

The second research aim was to examine the relationship between teachers' questions and children's responses in terms of the level of abstraction. Children's utterances were also coded based on the four levels of abstraction to conduct lag-1 sequential analysis, with teachers' question abstraction level as the given event and the level of children's responses as the target event. The sequential relations between teacher and child talk as represented by mean Yule's *Q* did not differ significantly across conditions (all $ps \geq .78$); therefore, in the subsequent sequential analyses we pooled data across conditions. The omnibus test examining these relations was significant, χ^2 (12, 39) = 602.15, $p < .01$. As shown in Table 3, several significant sequential dependencies were identified, and several very strong effect sizes were observed, as shown by the Yule's *Q* values in Fig. 1. The horizontal axis shows each teacher question type and the vertical axis includes Yules *Q* values that range from −1.0 to +1.0, with values closer to zero indicating no meaningful relation and values above ±.30 indicating a moderate effect. For example, the Yule's *Q* value for Level-1 teacher questions (found on the *x*-axis) and Level-1 child responses was .81 (found on the *y*-axis), indicating that there was a strong likelihood that children responded to Level-1 teacher questions with a Level-1 response. Whereas Fig. 1 shows the Yule's *Q* values for Level-1 teacher questions and child responses at all other levels of abstraction were negative, indicating that children were unlikely to respond to a Level-1 teacher question with any other response besides the same Level 1. Yule's *Q* values ranged from .81 to .93 for teachers' and children's utterances that were at the same level of abstraction indicating that there is a very strong likelihood that a teacher question at any level will be followed by a response from the child at the same level of abstraction. In terms of inferential questions, a Level-3 teacher question was most likely to be followed with a Level-3 child response ($z = 14.25$, $p < .01$, $Q = .84$), and a Level-4 teacher question was most likely to be followed by a Level-4 child response ($z = 14.02$, $p < .01$, $Q = .93$). Children also tended to match their response to the level of teacher questions at literal levels. The likelihood of a Level-1 teacher question and Level-2 teacher question evoking the corresponding Level-1 or Level-2 child

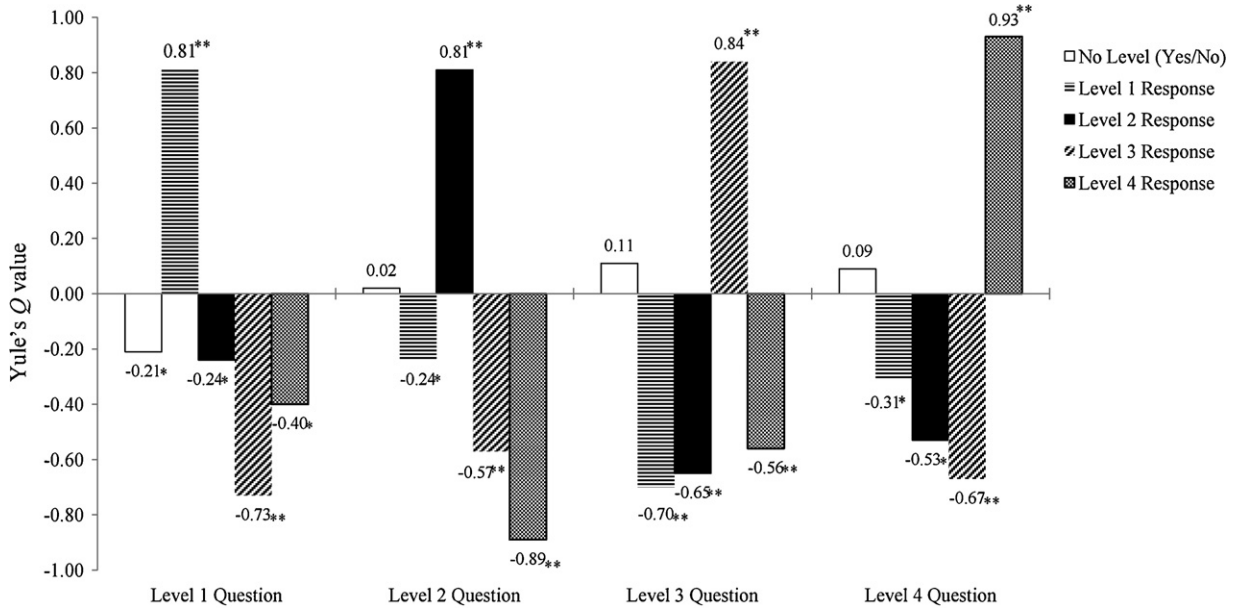

Fig. 1. Yule's *Q* values for teacher questions and level of child responses. Results of the sequential analysis with teachers' questions in terms of level of abstraction as the given and children's responses in terms of level of abstraction as the target. The direction and size of Yule's *Q* statistic is interpreted as follows: 0 to ±.29 negligible; ±.30 to ±.49 moderate; ±.50 to ±.69 substantial; and ±.70 very strong. $^{*}p \leq .05$, $^{**}p \leq .01$.

Table 4
Lag 1 Analysis with Teacher Question as Given and Child Utterance Length as Target.

	Non-Meaningful	Low	High	No Opportunity	Totals
Level 1 Question	8/10 (−.79~/−.16)	131/139 (−1.10/−.07)	87/102 (−2.07*/−.15)	118/93 (3.65**/.25)	344
Level 2 Question	10/7 (1.16~/.22)	91/100 (−1.38/−.10)	79/73 (.89/.07)	68/67 (.17/.01)	248
Level 3 Question	9/13 (1.49~/−.28)	205/182 (2.83**/.17)	135/133 (.30/.02)	100/121 (−2.87**/−.20)	449
Level 4 Question	7/3 (2.01~*/.40)	43/48 (−1.03/−.10)	42/35 (1.44/.15)	27/32 (−1.11/−.13)	119
Totals	34	470	343	313	1160

Observed frequency/expected frequency.
(Adjusted residuals [significant results $^{*}p < .05$; $^{**}p < .01$, ~ approximation, lacks normality]/mean Yule's *Q*).

response was also very strong (Level-1: $z = 13.41$, $p < .01$, $Q = .81$; Level-2: $z = 11.94$, $p < .01$, $Q = .81$). Below, we provide an example with corresponding codes (see Table 1) of an interactive exchange between a teacher and child that was situated mostly at Level 3 of abstraction. The majority of utterances in this exchange, which focused on building a snowman from play-doh, were coded as Level 3 because of the play-to-life connections (i.e., relying on prior knowledge of how to build a prototypical snowman).

Teacher: Now what are you going to add to your snowman? [TQ3]

Child: Buttons [CL3].

Teacher: What else do we have to put on the snowman in order to create a story for good reading [TQ4]?

Teacher: What goes around his neck [TQ3]?

Child: A scarf [CL3].

Teacher: And what goes on his head [TQ3]?

Child: Toboggan [CL3].

Teacher: What [MQ]?

Child: Toboggan [CL3].

Teacher: Toboggan, or a hat, or a cap [TO].

Teacher: What goes on his eye [TQ3]?

Child: Coal [CL3].

The data presented in Table 3 also show that teachers' literal questions were unlikely to elicit inferential child responses, as can be observed from the negative Yule's *Q* values displayed in Fig. 1. Specifically, the likelihood of a Level-1 teacher question being followed by a Level-3 child response was very low ($z = -7.71$, $p < .01$, $Q = -.73$). Similarly, Level-2 questions were unlikely to elicit Level-4 responses ($z = -3.73$, $p < .01$, $Q = -.89$).

Supplemental to these analyses were additional investigations of teachers' questions at Levels 1–4 and the complexity of children's subsequent utterances, based on the coding of Low- or High-MLU as a simple dichotomous coding scheme. The adjacency patterns and resulting test statistics appear in Table 4; the omnibus test statistic for this analysis was significant, χ^2 (9, 39) = 26.48, $p < .01$. Some significant sequential dependencies were identified, although the effect sizes for Yule's *Q* values were small as shown in Fig. 2. Teachers' Level-1 questions were likely to be followed (probability = .38) by a Low-production utterance ($p = .27$); another common pattern (probability = .34) was for Level-1 to be followed by no opportunity for the child to speak—that is, the teacher did not pause to wait for a response ($z = 3.65$, $p < .01$, $Q = .25$). Level-2 questions, on the other hand, were not strongly associated with a particular type of utterance from the child, although they were somewhat more likely (probability = .37) to be followed by a Low response ($p = .17$). Teachers' Level-3 questions, however, were most likely (probability = .46) to be followed by a Low-MLU response from a child, which was a significant relation ($z = 2.83$, $p < .01$, $Q = .17$). Finally, teachers' Level-4 questions were equally likely to be followed by a Low or High response (probabilities = .36, .35, respectively), although neither of these sequential relations were significantly different than chance. Interestingly, such findings suggest that teachers' level of abstraction was not consistently associated with the general productivity of child's responses. Thus, it is not the case that higher level questions consistently provoke longer responses from children.

To explore potential *bidirectional effects* whereby child's level of abstraction may influence teachers' subsequent level of question, we tested additional lag-1 sequential models where child's utterance level was the given event and teachers' utterance type (including questions and comments) was the subsequent target event (full models available upon request from first author). Although the model with level of child utterance as given was significant (χ^2 (20, 39) = 101.73, $p < .01$), 67% of the residuals were not normally distributed. The *p*-value for adjusted residuals assumes normality and is better when this condition is met; this limits our ability to interpret these relations because some of the row totals in the contingency table were less than 30 and some expected frequencies were extreme (<.10 or >.90; Bakeman & Quera, 2001). Moreover, the only significant effects were negligible except for one small moderate relation such that children's yes/no utterances (no level) were unlikely to be followed by a managerial question ($z = -4.20$, $p < .01$, $Q = -.41$). The same pattern of results was found with children's utterance length as the given (χ^2 (10, 39) = 46.75, $p < .01$) with most residuals lacking normality and the only significant findings were that non-meaningful and Low-MLU utterances were not likely to be followed by managerial questions ($z = -3.07$, $p < .01$, $Q = -.74$; $z = -4.24$, $p < .01$, $Q = -.27$), whereas High-MLU responses were somewhat likely to be followed by a managerial question ($z = 5.33$, $p < .01$, $Q = .34$). Taken together, the absence of significant relations when child's utterances precede teacher utterances suggests that the level of teachers' questions is primarily controlled by the teacher.

8. Discussion

The purpose of this study was to examine the extent to which teachers used inferential questions within the context of play, and to examine preschoolers' responses to these questions in terms of inferential demand. This study addressed gaps in the existing literature by examining teacher–child interactions rather than parent-child interactions, by examining play interactions rather than book interactions, and by using sequential analysis rather

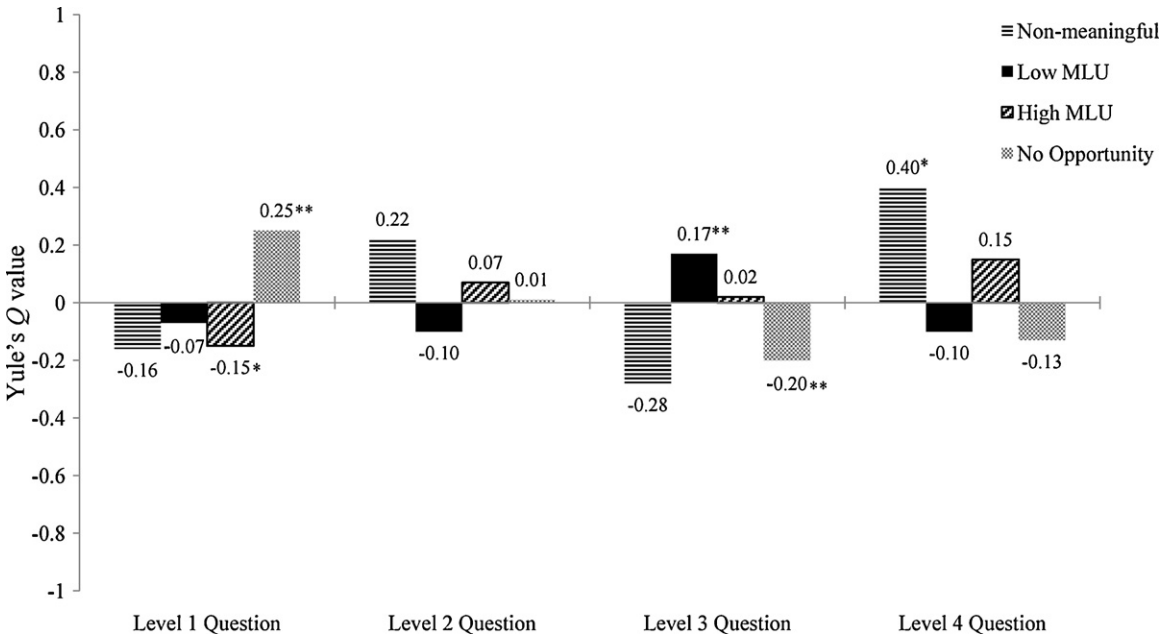

Fig. 2. Yule's *Q* values for teacher questions and length of child responses. Results of the sequential analysis with teachers' questions in terms of level of abstraction as the given and children's responses in terms of complexity (i.e., MLU) as the target. The direction and size of the Yule's *Q* statistic is interpreted as follows: 0 to ±.29 negligible; ±.30 to ±.49 moderate; ±.50 to ±.69 substantial; and ±.70 very strong. $^{*}p \leq .05$, $^{**}p \leq .01$.

than correlational methods to examine more directly how teacher inferential questions might elicit children's inferential talk during play. We have proposed, as have others (e.g., Rowe, 2012; van Kleeck, 2008; Zucker et al., 2010), that children's participation in conversations affording exposure to inferentially demanding talk is an important mechanism contributing to their future language abilities and reading comprehension. Importantly, for both theoretical and educational purposes, this study showed that the teacher–child play context may be an important means by which children engage in high-level conversations and that teacher questions of high inferential demand immediately evoke inferential responses from children.

8.1. Characteristics of teacher–child talk during play

Our first aim focused on describing teachers' questions and children's responses in terms of the four levels of abstraction. We found that approximately 25% of teachers' total utterances during the play-doh activity were questions. This proportion of questions is similar to Zucker et al. (2010), who found that about 28% of teachers' utterances while reading an informational narrative text with preschoolers were questions; likewise, de Rivera et al. (2005) reported that 37% of teachers' utterances with preschoolers during play-doh interactions were questions. It is unclear, however, whether de Rivera et al. (2005) included managerial questions (which we excluded), which may account for their larger proportion of teacher questions. Additionally, we found that teachers' questions were approximately equal in terms of inferential (48%) and literal (52%) questions, again similar to Zucker and colleagues' finding that 57% of teachers' questions were at inferential levels and 43% were at literal levels during book-reading interactions involving an entire class. Thus, while an informational narrative text may result in a slightly higher proportion of inferential talk, the proportions of teachers' overall questions as well as inferential questions in particular were quite similar in both studies.

Our findings, while compelling in their convergence with prior work, are particularly interesting given suggestions that informational texts may elicit a larger proportion of inferential talk compared to narrative books (Price et al., 2009; Zucker et al., 2010), and that their use of this book type may have resulted in a level of inferential questioning that is not typical of adults' questioning behaviors. However, the results of the current study suggest that similar levels of teachers' inferential questions may even be found in non-literacy activities, such as pretend play. One explanation for this finding is that the open-ended nature of play-doh activities in which there is not a single right/wrong way to use the materials leads to rich discussion about possible ways to manipulate the materials or causal questions to scaffold children's attempts to create objects. In a qualitative study in which adults played with children in literacy-enriched classroom centers (e.g., office setting), patterns of inferential talk were less prominent, perhaps because the adults were more focused on controlling children's play so that they would properly incorporate literacy into their play (Roskos & Neuman, 1993).

A second explanation for the high level of inferential questions observed in this study is that, although playing with play-doh may not seem likely to elicit the same type of abstract language elicited through a plotted storybook or informational text, teacher–child play may be more interactive than teacher–child reading. In support of this suggestion, Girolametto and colleagues found that teachers asked significantly more questions of preschoolers in a play-doh context compared to a book-reading context, and that children talked significantly more in the play-doh context (Girolametto, Hoaken, et al., 2000; Girolametto, Weitzman, et al., 2000). They also found that teachers were less directive and had more balanced turn-taking in the play-doh activity. Although Girolametto and colleagues did not examine inferential questions specifically, our results showed that teachers did include many inferential questions during play with preschoolers, as nearly 12% of their total utterances were of this type. This proportion is similar to Sorsby and Martlew (1991), who found that about 18% of mothers'

utterances during a play-doh task with preschoolers were inferential questions.

8.2. Teachers' inferential questions and child responses

The second research aim focused on determining whether inferential teacher questions elicited more inferential talk and potentially longer utterances from children compared to literal questions. The former interest (elicitation of more inferential talk) was our principal interest, as we surmised that child would map the inferential demand of their responses to the teacher questions to which they were responding. Using sequential analyses, we examined teachers' questions as the given and children's responses in terms of level of abstraction as the target. The results showed that for each of the four levels of abstraction, teachers' questions at a particular level were significantly more likely to elicit children's responses at the same level than to elicit children's responses that did not match the teacher's level. For example, a Level-3 teacher question was most likely to be followed by a Level-3 child response rather than a child response at a level above or below Level-3. Put simply, teachers' inferential questions were unlikely to elicit literal responses from children, and teachers' literal questions were unlikely to elicit inferential responses from children, a finding very similar to other book-sharing studies (Danis et al., 2000; Zucker et al., 2010). These findings provide a compelling expansion to the extant literature by showing that children map to the inferential demand of teacher questions outside of the book-reading context, thus suggesting that there are multiple contexts within the early childhood classroom in which children's higher-level language skills can be supported. In addition, our results suggest a potential mechanism for how adult–child inferential talk leads to children's later language skills and suggests that this mechanism may apply across different contexts.

It is also important to note that teachers and children were participating in a larger intervention study. The study was not intended to impact teachers' or children's inferential language (expression or comprehension); however, as part of the present work, we examined the rate of teachers' inferential questions and children's inferential responses in the small-group interactions. We observed that children in the intervention group produced significantly more inferences than children in the control group. Thus, while the intervention did not influence teachers' use of inferential questions directly, there may have been other aspects of the intervention that improved children's ability to engage in abstract dialogue. Additionally, teachers' years of education, but not years of teaching experience, was significantly related to how many inferential questions they posed to children. These exploratory findings suggest future research on the nature of inferential talk in classrooms, including the possibility that teacher training in responsive conversations might influence children's ability to engage in inferential dialogue and how teachers' background may affect the nature of their talk with children.

In terms of the productivity/complexity of children's responses to teacher questions across the varying levels of inferential demand, we found that teachers' Level-1 questions were likely to be followed by children's Low-production utterances or followed by no opportunity for the child to speak, the latter of which was significantly different than chance. These results differ slightly from Zucker et al. (2010) who found that teachers' Level-1 questions while reading an informational text (with high amounts of onomatopoeia) were most likely to elicit non-meaningful utterances from children, such as sound effects. This finding suggests that when teachers ask a low-level (perceptually focused) question, such as a request for a child to locate or label an object or action, that they often do not wait for children to respond verbally. Similar to Zucker et al. (2010), we found no significant relationship between teachers' Level-2 questions and children's utterance complexity. However, unlike Zucker et al. (2010), who also found no relationship with Level-3 questions; we found that teachers' Level-3 questions were most likely to elicit Low-MLU utterances (i.e., 1 or 2 morphemes) from children, which was significantly different from chance. Although it may be surprising that inferential teacher questions did not elicit High-MLU responses (i.e., 3 or more morphemes), we also found that teachers' Level-3 questions were less likely to elicit non-meaningful utterances from children. Many Level-4 questions elicited non-meaningful or filler word responses. Finally, teachers' Level-4 questions were equally likely to be followed by children's Low- and High-MLU utterances, although these sequential relations were not significantly different from chance. This finding also differs from Zucker et al. (2010), who found that teachers' Level-4 questions tended to elicit High-MLU responses from children. Although children in the current study produced more High-MLU than Low-MLU utterances, the level of abstraction of teachers' questions did not predict MLU. These findings suggest that other aspects of teachers' questions during play besides level of abstraction may predict children's MLU. Another possibility is that coding of teacher questions with greater specificity (e.g., closed vs. open-ended questions, etc.) may produce different results given that other researchers have found open-ended questions to be particularly facilitative of children's responsiveness (Wasik, Bond, & Hindman, 2006). However, this coding was beyond the scope of the current study and could be examined further by future researchers.

Finally, we explored bidirectional effects of these play interactions by examining children's utterances as the given and teachers' questions and comments as the target using sequential analysis. We found that two thirds of the residuals were not normally distributed and that there were only a few significant moderate relations among children's utterances (in terms of levels of abstraction and children's MLU) and teachers' subsequent questions. Given that teachers' questions function to elicit a response from children, it should not be surprising that children's utterances preceding teachers' questions were not typically related to teachers' subsequent questions. However, it is important to ensure that children were not driving these conversations. Our results seem to support the conclusion that the level of teachers' questions is driven by the teacher rather than the children in the group.

8.3. Practical implications

An important strength of the present study was the focus on teacher questions as used within play, which are a key speech act to examine because questions are more likely to elicit a response from children compared to directives or comments. Teachers' use of questions is a dominant part of the classroom discourse environment, and can provide an important means for engaging children in dialogues. However, as van Kleeck (2004) points out, many of the studies on the literal-to-inferential continuum of adult–child talk have not examined questions separately (e.g., van Kleeck et al., 1997). She argues that questions are important because they socialize children to be involved in these interactions and teach children how to demonstrate their knowledge with a more capable peer who can scaffold their exposure to complex concepts. Exposure to inferential questions (e.g., What will happen next?) during the 3- and 4-year-old preschool years is developmentally appropriate (Rowe, 2012) and important because these are the types of questions that mature readers will eventually use to comprehend written text (van Kleeck, 2004).

Examining the relationship between teacher inferential questions and children's responses within the early education environment has practical educational applications in terms of developing interventions to improve the linguistic quality of

teacher–child interactions given that the quality of the preschool classroom language environment is often low (Justice, Mashburn, Hamre, & Pianta, 2008a; Wilcox-Herzog & Kontos, 1998; Winsler & Carlton, 2003). However, Wasik and colleagues have shown that when teachers of preschoolers at risk were trained to ask interactive (including both literal and inferential) questions during book reading, that children in these classrooms engaged in more conversations with teachers and peers and had better vocabulary skills than children in control classrooms (Wasik & Bond, 2001; Wasik et al., 2006). In these studies, however, several techniques were targeted simultaneously; thus, the specific influence of inferential questions could not be determined. In a similar intervention study, van Kleeck et al. (2006) showed that when interventionists working with preschoolers with language disabilities were trained to ask both literal and inferential questions during book reading, that children had significantly better literal (i.e., vocabulary) and inferential language skills compared to the control group. Again, however, this study did not specify the specific effect of inferential questions on children's participation in higher-level conversations involving inferential talk. Rather, these three intervention studies demonstrate that a combination of literal and inferential questions improves children's literal and inferential language comprehension over time. The results of the current study further specify the mechanism by which this growth may occur, and suggest that teachers' inferential questions specifically are related to children's own production of inferential language.

Another practical implication of the present work is that the results suggest that play interactions are a valuable activity in the preschool classroom. According to the National Research Council (1998), one way in which teachers can promote preschoolers' language skills is by becoming involved in play settings and guiding children's learning through interaction. Our study suggested more precisely how teachers may get children talking about more abstract concepts specifically when playing with play-doh. However, these same conversational devices could be used by teachers in a wide range of play-based activities in the classroom, such as role playing. Considering that children spend a great deal of their time in the preschool setting engaged in play, it will benefit educators and researchers to know what types of linguistic interactions should be promoted in these contexts. In a large-scale study of public preschool programs, Chien et al. (2010) found that children spent the largest proportion of their day on average in play, and a relatively small proportion in small-group activities; however, they did not examine how much of children's play was in teacher-guided play or the quality of these interactions. The results of the present study suggest that teacher-guided conversations during play that feature relatively modest exposure to inferentially demanding questions posed by the teacher (about 12% of all utterance types), provide children an opportunity to engage in conversations that involve predicting, reasoning, planning, and hypothesizing. Practice with such higher-level applications of language may make an important contribution to children's future ability to deploy such skills to reading for meaning.

8.4. Limitations and future directions

We must point out several limitations of this work. The first limitation of the current study was that we did not examine teachers' questions in relation to standardized assessments of children's language skills; rather, we were interested in the moment-by-moment interactions that take place within children's classrooms. Although researchers have not typically found significant correlations between adults' inferential language and children's immediate language outcomes, such as vocabulary (e.g., Sigel & McGillicuddy-DeLisi, 1984; van Kleeck et al., 1997), some work has shown that teachers' inferential talk during storybook interactions predicts children's later language skill (e.g., Dickinson & Porche, 2011; Hindman et al., 2008). We, however, cannot draw any conclusions as to whether the teacher–child patterns of talk we observed have long-term implications to development, despite this study's in-depth analysis of children's exposure to and experiences with higher-level talk during play. A related limitation is our use of MLU as a measure of children's language complexity; while considered a reasonable proxy for syntactic development among younger children, once children are four and half years of age and older it is not considered very sensitive (e.g., Scarborough, Rescorla, Tager-Flusberg, Fowler, & Sudhalter, 1991). The use of other and more sensitive measures of language complexity, such as clausal complexity, would be an interesting feature of future works on this topic.

Another limitation of our coding scheme is that it does not allow for examination of multi-utterance or multi-turn exchanges on a given topic (e.g., how to build a snowman) compared to shorter bouts of turn-taking that jump from topic to topic. Although our primary goal was to examine whether teachers' inferential questions elicit children's responses moment-to-moment, other types of analyses that could take into account the length, and thus depth, of these multi-turn exchanges may also be useful in identifying the mechanism by which teachers engage children in sustained talk about inferences. For example, other researchers have looked beyond adult questions and children's immediate responses to examine multiple bouts of turn-taking and adults' expansion of children's initial responses (e.g., McKeown & Beck, 2003).

A third limitation of this study concerns our sample. We investigated teachers in targeted-enrollment preschool classrooms while interacting with a subset of children in their classrooms. The sample of children in these classrooms had language skills that, on average, lagged behind what we might see in a more advantaged sample. We are unclear as to whether our results can generalize to other contexts in which young children are cared for. For instance, is the level of inferential talk observed in this study similar to what we might see in preschool classrooms serving advanced children, children with disabilities, or in preschool classrooms serving younger 2- and 3-year-old children? Additionally, it is unclear how this group of teachers generalizes to teachers elsewhere. These teachers may differ from other teachers in that they volunteered to be part of this study and were willing to submit video recordings of their classroom practices. It is also possible that in selecting children for the videotaping sessions, teachers employed some set of criteria that biased the sample, such as children who have relatively high levels of language skill or who are more talkative. Thus, we encourage the replication of this work in other sectors of early schooling. A related limitation is that we selected a structured play activity for the basis of the sequential analysis. Because these particular teacher–child interactions were done on request, it is not clear whether the same patterns of inferential talk would be present in more naturalistic (and likely less sustained) interactions in the preschool classroom or how conversations may vary across a full taxonomy of simple to complex pretend play activity contexts (Roskos, 1990).

Finally, we make comparisons in the current study between levels of abstraction in the book context and the play context. However, the coding of inferential utterances in the play context may not be exactly analogous with the inferences afforded by books. Books for young children can contain a great deal of complexity in the semiotics of illustrations presented and the possible meanings beyond the text; for example, inferring that a character is feeling a particular emotion based on a sequence of actions from the previous pages. A child relying on his or her prior knowledge of how to build a snowman when playing with a simple prop (as illustrated in the example above) may not represent the same level of complexity as when an adult asks the child to draw from his or her prior knowledge when listening to a storybook. Nonetheless, the present

study did show that it is possible to categorize teacher–child play interactions in terms of levels of abstraction. Future work is needed to determine if individual differences in the amount of adults' inferential talk in the play context predicts children's later language skill. If it does, this would suggest that characterizing adults' level of abstraction in the play context as we did in the present study does parallel the work on adult–child book-reading interactions and children's subsequent language skill.

9. Conclusion

To summarize, the results of this study provide an important complement to other work examining the early childhood classroom as a context for language development. Previous work has involved considerable descriptive analysis of teachers' use of abstract language with preschoolers in book-reading interactions (e.g., Dickinson & Smith, 1994; Hindman et al., 2008; Zucker et al., 2010), and has involved experimental work showing that children's language skills can be improved through instructional practices which focus on abstract language use during book reading (e.g., van Kleeck et al., 2006). Furthermore, longitudinal work has indicated that exposure to such talk may contribute in important ways to future language and reading achievement (e.g., Dickinson & Porche, 2011). The present study uniquely contributes to this body of work by examining abstract language in the context of play in the preschool classroom. Given the current emphasis on promoting inferential language skills in prereaders (van Kleeck, 2008) and the amount of time preschoolers typically spend engaged in play activities in the classroom (Chien et al., 2010), we felt a descriptive analysis of the language used in teacher–child play conversations was needed. The present study suggests that pretend play can provide a useful venue for cultivating children's experiences with inferential talk, and that children tend to map onto the level of inferential demand solicited from them by teachers in a play context.

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