Joint Engagement Behaviors in Preschoolers with Language Impairment

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A thesis

submitted in partial fulfillment of the

requirements for the degree of

Master of Science

University of Washington

2019

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Program Authorized to Offer Degree:

Speech and Hearing Sciences

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Abstract

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The present study aimed to extend the joint engagement literature to the sample population of preschoolers with language impairment (LI) by exploring patterns of joint engagement behaviors in this population. A second question asked if joint engagement behaviors were significantly related to performance on language measures. Following referral from local speech-language pathologists, the joint engagement behaviors exhibited by 14 preschoolers with LI during play-based language samples were rated using behavioral rating items adapted from Adamson, Bakeman, and Suma (2016). We conducted descriptive statistics and correlational analyses to examine total joint engagement (JE), symbol-infused joint engagement (SIJE), and fluency and connectedness (FC). Our findings revealed SIJE and FC are significantly correlated to language measures, confirming previous evidence that supports the significance of joint engagement behaviors in language development, and broadening this line of research to include our sample population of preschoolers with LI. We also highlight the importance of considering a child's joint engagement and language skills across domains, examining the child's complete profile.

Language development is a dynamic, multi-faceted phenomenon that is intricately complex. An idea rooted in Vygotsky's (1960) theory of language development, it has long been established by researchers and experts in the field that early language exposure within dyadic interactions serves as the driving force for typical language development (Hart, & Risley, 2003; Kuhl, 2011; Romeo et al., 2018; Topping, Dekhinet, & Zeedyk, 2013). This study broadly intends to investigate patterns of joint engagement behaviors during dyadic interaction between preschool children with language impairment (LI) and a trained clinician during brief language samples. In addition, this thesis aims to examine the possible relationship between these joint engagement behaviors and language skills. The following introduction serves as a comprehensive review of the existing evidence on the role of joint engagement behaviors in language development, with a focus on the gaps in current understanding of joint engagement behaviors and their role in the language development of children with LI.

Dyadic Interaction in Infancy

From an early age, infants exhibit skills that indicate awareness and sensitivity to others in their environment. These skills serve as the foundation for reciprocal dyadic interactions, or interactions between two communication partners (most often an infant and his or her caregiver). As early as two months of age, infants begin to demonstrate a sensitivity to social contingencies, opening the door for dyadic interactions and socially-mitigated language learning (Bigelow & Rochat, 2006; Striano, Henning, & Stahl, 2005). For example, Bigelow and Rochat found that two-month-old infants were more likely to respond to strangers whose communication characteristics (in this case, response timing and frequency) were most similar to the that of the infant's mother's style. This shows that infants differentiate between, and even respond differently to, specific patterns of communication within dyadic interactions. A study by Gratier

et al. (2015) revealed that, between two and five months, an infant's behavior during a turn-taking interaction (e.g., pauses, duration of turns, number of turns) changed as a result of his or her intentions (e.g., self-expression, joint engagement). These findings suggest that infants play an active role in establishing and shaping dyadic interactions.

This study Gratier et al. (2015) also introduces an important consideration in the present investigation. Even within the dyadic interaction (evidenced in their study by turn-taking sequences), the specific components of the infant's contribution in the interaction changed when the dyad was in a state of joint engagement. Joint engagement states, or observable states of interaction in which both partners in a dyad actively sustain focus to a shared object or action (Smith, Adamson, & Bakeman, 1988), are considered distinct contexts within dyadic interactions. It is within reciprocal dyadic interactions that infants develop the critical joint engagement skills that lay the foundation for language development. All of this evidence supports the notion that specific attention to these interactions are warranted in the present study. Joint engagement states will be discussed further in subsequent sections of this paper.

Importance of Dyadic Interaction for Language Development

Language learning is influenced by not only an infant's proclivity for social interactions, but also by the infant's communication partner. Especially during infancy, communication partners are essential in creating and upholding dyadic interactions in order to provide a rich language learning environment (Beebe, Jaffe, & Lachmann, 1992; Bruner, 1975; Stern, Jaffe, Beebe, & Bennett, 1975). The nature and purpose of dyadic interactions change as a baby ages. For example, when a baby giggles and its parent comments "Oh, you're happy," the parent is both attributing meaning to the baby's vocalizations and teaching the infant that its own actions elicit a response from other people. At a later age, when babies engage in more purposeful and

focused activities (e.g., playing with blocks), the role of the communication partner shifts. At this point, communication partners serve as naturalistic educators, teaching babies not only the labels for objects in their immediate environment, but also overall language structure and use. Dyadic interactions allow young children to attribute meaning to shared experiences (Tamis-LeMonda, Kuchirko, & Song, 2014). Striano, Henning, and Stahl (2005) argue that further research is needed to examine how dyadic reciprocal interactions during infancy facilitate the awareness of intentionality in communication that drives interaction-based language learning during childhood.

Researchers have also shown that specific behaviors of an infant or toddler's communication partner within dyadic interactions influence language development. Examples of these influential factors include responsivity rates, contingency, imitations, and turn-taking (Conway et al., 2018a; Romeo et al., 2018; Topping et al., 2013). Tamis-LeMonda and colleagues (2014) explored the value of parental responsivity (i.e., responding to infant's early communicative behaviors) in the development of an infant's sense of intersubjectivity, or the concept that speakers communicate with intent and an expectation that the listener will respond accordingly. This idea is aligned with the notion that early parental responsiveness is the mechanism through which infants learn the intentionality of interactions and communication (Tamis-LeMonda et al., 2014). Additionally, parental responsiveness is closely related to the importance of conversational turns within infant interactions. Pre-linguistic turn-taking between infants and their caregivers (i.e., exchange of vocalizations) has been identified as highly influential in the development of language (Levinson, 2016). Conversational turns provide opportunities for children to practice using language and receiving feedback from adult communication partners (Romeo et al., 2018). Another study found that maternal imitations of

infant vocalizations influence language development, perhaps by providing infants with immediate feedback to indicate that their actions have meaning to others (Smith et al., 2017). Smith and colleagues also point out that imitations support the transition from pre-intentional to intentional communication and provide the child with an adult model of their early word approximations. The role of an infant's communication partner in shaping early language development is extensive, and each component serves multiple purposes in teaching the infant foundational skills for communicating in dyadic interactions through the early years.

Within the dyad, researchers have also focused specifically on how both the quality (i.e., variety and complexity) and quantity (i.e., volume) of language input impacts the development of the child's language system (Hoff, 2006; Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010; Romeo et al., 2018; Rowe, 2012). Whereas it is undeniable that a large volume of diverse input is necessary for optimal development, some in the field have investigated further to understand the dynamic interaction between quality and quantity of input. Hirsh-Pasek, et al. (2015) claim that focusing strictly on the quantity of words a child is exposed to within a communication interaction does not properly account for the language-facilitating qualities of dyadic communication. These authors found that later language skills were more associated with characteristics of the interaction (i.e., joint engagement and routines), rather than the number of different words a child heard.

Romeo et al. (2018) found supporting evidence that qualitative measures, in this case conversational turns, may have a greater impact on language development than quantitative measures alone. The authors observed that the quantity of input was not significant enough to account for the power of conversational turns on later verbal skill and neural language processing. Conversational turns provide a diverse communicative environment that promotes

language learning in interactions. This study is one of the first to demonstrate that high quality input remains significant past the toddler and preschool years, at least until the age of six.

Other studies have considered how the relative necessity of quantity and quality of language input change throughout the typical developmental sequence. Rowe (2012) proposes a pattern of variation of input quantity and quality over time. She purports that it may be beneficial to shift from a focus on quantity at the age of two years old to variability and complexity during the child's third and fourth years. This is recommended to best support the dynamic nature of the child's developing language system and points to the need for additional research on the role of dyadic interactions during the preschool years and beyond.

Additionally, preliminary evidence has even shown that early language input influences brain development, neural language processing, and activation patterns. The above-mentioned study by Romeo et al. (2018) also identified that significant neural activation patterns and later verbal language skills were significantly influenced by dyadic interactions. Their results showed that, during conversational turn-taking, Broca's area was activated with a magnitude that accounted for 48% of the relation between conversational turns and verbal language scores. Children who experienced more conversational turns had a significantly greater amount of activation in Broca's area during language processing. This means that conversational turns, a component of quality of input, influences neural activation patterns in communication centers in the brain during language processing. Essentially, this study found that the quality of language input contributes to neural activation patterns that result in language learning. Although the relative contributions of the quality and quantity of language input in early language development are still hotly debated, it is clear that language input within dyadic interactions

plays a vital role in both the environmental and biological processes that contribute to language development.

The Gaps in the Literature

In stark contrast with the seemingly endless body of literature that examines language development in typically developing children, the field contains minimal evidence about language trajectories in children who are not typically developing. After a thorough review of the literature, the following questions remain.

What happens after infancy and toddlerhood? Given that language development has been proven to be predominantly interaction-driven, researchers have sought to characterize patterns of dyadic interactions and investigate their contribution to specific components of language development (e.g., vocabulary, grammar, and lexical acquisition) during the early years of childhood. Up until this point, however, the focus of research has been heavily on language input during interactions (primarily with caregivers) through the toddler years. The question remains: how do dyadic interactions continue to develop after age three and which features of the interaction are most correlated with language learning?

A growing body of literature has examined changes in interactions during preschool and how this may impact language development, such as interactions with teachers, quality and quantity of teacher input, frequency of teacher recasts/expansions, and overall qualities of the preschool classroom (e.g., positive peer-to-peer and child-teacher relationships) (Cabell, Justice, McGinty, DeCoster, & Forston, 2015; Justice, Jiang, & Strasser, 2018; Schechter & Bye, 2007). Preschool teachers' use of communication-facilitating behaviors in interactions (e.g., using open-ended questions, using a slow pace of conversation) have been strongly related to typically developing children's vocabulary development (Cabell et al., 2015; Justice et al., 2018). Even for

children with developmental language delays, the teacher-child relationship has been correlated with better classroom-learning behaviors in preschool (Rhoad-Drogalis, Justice, Sawyer, & O'Connell, 2018), confirming that this influence of adult input in interactions remains in preschoolers who are not typically developing.

What about language output? The continued impact of adult input within dyadic interactions past toddlerhood has been established. Yet, little research has considered the bi-directionality of interactions and its relationship to language development during the preschool years; we know very little about how children's interactions with their own environment (specifically in the context of language-based, social interactions) continue to impact language development during preschool. Few studies have examined how, as children age, their own style of interaction impacts their language development. This is particularly relevant as children's language learning contexts shift from interactions with primary caregivers to more diverse social environments including preschool, playgroups, and other peer-to-peer interactions.

Mani and Ackermann (2018) propose that, although the role of language input is undeniable, children should be considered agents responsible for the variability in their own learning. They describe a curiosity-driven language learning pattern, specifically for word learning. That is, children are motivated to learn about what they are interested in, and have subsequently been observed to more-readily learn words related to their interests. Additionally, around the age of 3 years old, children begin to demonstrate preferences for the time, place, and communication partners in interactions (Partridge, Mcgovern, Yung, & Kidd, 2015). An interesting study by Ionescu & Ilie (2018) found that preschoolers more-readily learned new vocabulary words when they participated in an "embodied learning" activity. This activity incorporated a variety of multi-modal input and body movements that included both cognitive

and non-cognitive elements. Language learning in preschool involves more than direct, input-based instruction. All of this evidence further supports the notion that children should be considered powerful participants in shaping their own language development through interactions, even in the preschool years. It is imperative that we understand how a child's contribution within dyadic communication may impact language development, especially given the shift in interactional expectations as children age and the fact that preschool provides children with more independence to initiate and support dyadic interactions.

What about children with LI? It is also important to consider how interaction-based language learning in children with LI may not be commensurate with their typically developing peers. Stanton-Chapman, Justice, Skibbe, and Grant (2007) found significantly less-developed social skills in a sample of preschoolers with LI, as compared to their typically developing peers. These findings corroborate previous studies that describe social skill deficits in children with LI or delay (Guralnick, Connor, Hammond, Gottman, & Kinnish, 1996; Guralnick & Groom, 1985; McCabe & Meller, 2004; Reynolds & Holdgrafer, 1998). This introduces the question: it is the LI that is contributing to reduced interactional skills or is the reverse true? Nevertheless, this evidence sheds light on the intricate relationship between language and interactions; children with LI often do not have the age-appropriate social skills necessary to engage with teachers or peers, which, in turn, limits the number of opportunities they have to participate in language learning contexts. This evidence shows us that children with LI exhibit differences in social interactions, which may be related to language skills.

The Present Study

To address these gaps in the literature, the present study investigated the joint engagement behaviors of preschoolers with LI during dyadic interactions. Specific joint

engagement behaviors during play in preschoolers were examined. We utilized joint engagement rating items to characterize joint engagement behaviors within dyadic interactions (Adamson, Bakeman, Deckner, & Nelson, 2012). Rating items have been established as a valid method of interaction analysis in both children who are typically developing and children with developmental disorders (Adamson et al., 2012). These rated behaviors included total joint engagement, symbol-infused joint engagement, and fluency and connectedness within the interaction. The primary aim of this study was to characterize the patterns of these behaviors (if any) in children with LI.

Additionally, because preschool is a time of rapid growth in the language system, this investigation went on to examine potential relationships between these joint engagement behaviors and broader language skills. In preschool, children are expected to demonstrate competencies in both receptive and expressive language products and processes. We were particularly interested in vocabulary (product), grammar (product), and lexical acquisition (process).

In the interest of classifying our relatively small sample as a homogenous group, our participants were primarily characterized as sample children with LI. At this point, however, is important to note that a distinct subgroup within this sample exists: children with a diagnosis of LI and a concomitant diagnosis if autism spectrum disorder (ASD). Previous evidence justifies the classification of children with LI and concomitant ASD as a subgroup of LI, given a "theoretically significant" overlap between the language profiles of these populations (Kjelgaard, & Tager-Flusberg, 2001). Though, considering that ASD, by DSM-5 definition, includes "persistent deficits in social communication and social interaction" as a hallmark characteristic (American Psychiatric Association, 2013), it is possible that the presence of ASD may result in

significant differences in joint engagement behavior ratings and corresponding language skills. We will examine the potential effects of a concomitant ASD diagnosis in our study results through subgroup analyses.

The following section describes the joint engagement behaviors rated in this study and explores how each of these behaviors have been related to language skills, first in typically developing children and then in children with LI.

Joint Engagement Rating Items

Total joint engagement. The first parameter through which these interactions were explored is total joint engagement (JE). Described early on by Smith, Adamson, & Bakeman (1988), JE is an observable state or period of interaction in which both partners in a dyad actively sustain attentional focus to the same shared object or action. The quality, quantity, and type of JE states have been linked to the development of social, cognitive, and linguistic factors that contribute to both overall language development and specific components of developing language (Adamson, Bakeman, Deckner, & Nelson, 2014; Moll, Carpenter, & Tomasello, 2007; Nelson, Adamson, & Bakeman, 2008; Wong & Kasari, 2012).

Further, JE has been directly connected with lexical acquisition. In fact, JE states provide the exact referential framework over a period of time that many argue is an essential component of lexical acquisition (Conway et al., 2018b; Tamis-LeMonda et al., 2014). Dunham, Dunham, and Curwin (1993) found that dyadic interactions in which communication partners follow the child's attention better-facilitated word learning than those in which the child was required to switch attention to the novel referent. For example, when an infant is learning the name of his favorite toy, research shows that it will be most easily acquired when the communication partner follows the child's attention and provides the label "ball" when the child is already looking at,

touching, or playing with the ball. This child-led learning approach is more effective than if the child were to be playing with a car and the communication partner were to call the child's attention to the ball and say "ball." This provides evidence in support of Tomasello's theory (1988) that shared attentional states promote lexical acquisition. Both authors found that these child-centered episodes of JE resulted in more efficient word learning.

Similar to JE yet distinct, joint attention is a concept that is often also attributed to language development. It is important to explore and distinguish how joint attention and JE coalesce in the context of dyadic interaction. The distinction between joint attention and JE is nuanced: joint attention refers to a set of skills that are employed during episodes of JE (Adamson et al., 2014). In other words, JE is a state of being, whereas joint attention refers to particular behaviors within that state that indicate and support shared attention between members of a dyad (e.g., gaze, pointing + looking, etc.). Both have been attributed to language development in typically developing children. The present study, however, exclusively examined JE, not joint attention, because experts agree that JE states provide the best representation of the context in which language development occurs (Adamson, Bakeman, & Deckner, 2004; Conway et al., 2018b).

Symbol-infused joint engagement. The scope of interactions during episodes of joint engagement drastically changes once partners in the dyad begin integrating symbols, such as words and meaningful gestures (Adamson et al., 2014). This state is known as symbol-infused joint engagement (SIJE). The infusion of symbols during joint engagement states allows the dyad to communicate about abstract concepts that are not in the here and now (Adamson et al., 2004). In a state of SIJE, a child is actively paying attention to and using symbols. These symbols are most often in the form of spoken language, but can also be gestures or other non-verbal, yet

symbolic actions (Adamson et al., 2004). In typically developing toddlers, this process begins to emerge around 18 months and continues to develop over the next two years (Adamson et al., 2004). At 30 months, one group of typically developing toddlers spent, on average, 31% of the time during a play interaction in SIJE (Nelson et al., 2008). As children develop into the preschool years, the structure and focus of SIJE progress as well. The symbols used become more complex and the child becomes more adept at initiating and maintaining these symbol-infused interactions. There is preliminary evidence that periods of SIJE, rather than triadic focus (on partner, object, and symbol), provide children with an extremely facilitative language learning context. Namely, SIJE provides explicit focus on a specific event and its symbolic representation (Adamson, Bakeman, Deckner, & Romski, 2009). In fact, higher rates of SIJE have been correlated with an increased vocabulary size (Adamson et al., 2004; Adamson et al., 2012). These findings provide further support for the increasingly prevalent theory that language development is an interaction-based and symbolic process that remains influential throughout the preschool years.

Fluency and connectedness. Another parameter through which the quality of dyadic interactions can be assessed is fluency and connectedness (FC), or the overall flow and cohesion of a dyadic interaction (Hirsh-Pasek et al., 2015). This concept is evidenced by how balanced an interaction is, how well the dyad flows within and between topics, and the frequency and balance of turn-taking. Hirsh-Pasek et al. argue that contingent language, in other words, language that exists within fluent and connected interactions, contributes to the foundation of later word learning in parent-child dyads. They found that FC is a relatively strong predictor of later language skills and lexical acquisition, as compared to other components of dyadic interaction. FC of conversation has been demonstrated to be an active component of interactions as early as

12 months of age (Smith et al., 2017). FC in dyadic interactions continues to facilitate word learning as a child's social and linguistic skills become more developed and complex. A study by Roseberry, Hirsh-Pasek, & Golinkoff (2014) found that toddlers were more adept at learning novel words within, rather than removed from, interactions. Hirsh-Pasek et al. specifically emphasized how their findings corroborate existing evidence that disruptions in the FC of interactions may in fact have an adverse effect on word learning. This evidence in typically developing children furthers the notion that FC in dyadic interactions play an imperative role in language development and lexical acquisition.

Patterns of These Behaviors in Children with LI

Whereas some of these behaviors have been examined extensively in typically developing children, very little research has specifically sought to describe these behaviors in children with LI. The following section serves as a review of what evidence exists regarding these joint engagement behaviors in children with LI.

JE. Multiple studies have investigated JE patterns in a variety of populations (Adamson et al., 2009, 2012; Adamson, Deckner, & Bakeman, 2010; Hahn, Brady, Fleming, & Warren, 2016; Patterson, Elder, Gulsrud, & Kasari, 2014; Wong & Kasari, 2012), but only one has focused on children with language deficits exclusively (Conway et al., 2018b). This team of researchers found that supported joint engagement (i.e., a state in which the communication partner is actively influencing the child's experience in an interaction, but the child does not recognize this involvement) was correlated to later performance on receptive and expressive language measures (taken at 24, 36, and 48 months) in "slow-to-talk" toddlers. This is the first evidence of its kind that suggests JE may play a facilitative role in the language development of children with language deficits. However, it is important to note that the focus on "supported"

joint engagement in Conway et al.'s study is related to the behaviors of the child's communication partner (i.e., language input) rather than the behaviors of the child.

SIJE. To our knowledge, there have been no studies that specifically examine SIJE in children with LI. However, Adamson et al. (2009) found varying rates of SIJE in other neurodiverse populations. Children with Down syndrome demonstrated significantly less SIJE than their typically developing peers. The authors concluded these results evince remarkable variations in the development of SIJE. It remains unclear how LI and SIJE may relate.

FC. Only one study has directly examined the FC of conversation in children with LI. These findings came from the same Conway et al. (2018b) article discussed above in regards to JE in children with language deficits. A different research question within the same study found that FC during mother-child interactions was correlated with current and later receptive and expressive language skills in "slow-to-talk-toddlers" (Conway et al., 2018b). The authors discussed the importance of recognizing that it requires both members of a dyad to maintain the FC of conversation. Thus, children with a language delay or impairment may not have the skills to uphold the FC of conversation, potentially restricting the interaction.

How do these joint engagement behaviors relate to language development in children with language impairment? To our knowledge, there is little to no evidence that examines how these behaviors impact language skills in children with LI. These gaps in the literature highlight all that we do not know about how children with LI learn language and how their own contributions to dyadic interactions influence their language development. All of these unknown variables underscore the significance of our research questions.

Research Questions and Hypotheses

As recently as 2018, researchers have been emphasizing the need to continue investigating the bidirectional nature of dyadic interactions in language development. Given the potential implications for assessment and intervention of children with LI, study within this domain is warranted. The current study will address two research questions in order to contribute to the field's understanding of joint engagement behaviors in preschoolers with LI.

First, what patterns of joint engagement behaviors (if any) do preschoolers with LI exhibit within a dyadic interaction (RQ 1)? The purpose of this aspect of the current investigation is to explore how children with LI contribute to dyadic interactions, a crucial component of language development. Conway et al. (2018a) argue that research should consider language development as a bidirectional phenomenon. The authors highlight a need for research that incorporates child behaviors when examining dyadic interactions. This is what the current study aims to do. Considering that these behaviors are associated with complex language skills, it is reasonable to predict that 1) we will observe high variability in patterns of joint engagement behaviors and 2) we may find differences in joint engagement behaviors at the group level (i.e., children with LI compared with children with LI + ASD). However, it is important to take into account that the behaviors we are coding also include nonverbal in addition to verbal communication. It is possible that we find that children with LI compensate using nonverbal communication to maintain the overall interaction.

Our second focus is to determine how patterns of joint engagement behaviors within dyadic interactions are related to performance on measures of receptive and expressive language (i.e., vocabulary, grammar, lexical acquisition) in preschoolers with LI (RQ 2). We hypothesize that children who demonstrate lower rates of JE, engage in less SIJE, and/or have less fluent and

connected interactions will score lower on language measures. Given what we know about these behaviors and their overall relation to language development and language complexity, combined with what we know about children with LI, we believe that these measures will be correlated with, and may even uniquely contribute to, underlying language skills.

Methods

Participants

A total of 14 participants (10 male; 4 female) with a mean age of 4 years 9.74 months, (SD= 6.68 months, range=23.6 months) met the eligibility criteria and were included in this study. Participants were referred by speech language pathologists (who worked in either a developmental preschool program or a university-based speech and language clinic) if they met eligibility criteria. Eligibility criteria for this study included: an existing diagnosis of LI or considered to be at risk for LI, qualification for services through an Individualized Education Plan (IEP), and/or a client on the caseload of an SLP. Additional inclusion/exclusion criteria for this study include: access to language sample information, complete Quick Interactive Language Screener (QUILS; Golinkoff et al., 2017) computerized language screener, and adequate language sample recording quality. Table 1 presents the demographic information and reported diagnosis for all participants.

Table 1
Demographic Information

Variable	n=14
Gender	
Male	71%
Age Group	
3;0-3;11	14%
4;0-4;11	57%
5;0-5;11	29%
Diagnosis	
Receptive Language Impairment	7%
Expressive Language Impairment	7%
Mixed Receptive/Expressive Language Impairment	14%
Neurodevelopmental disability with diagnosed language impairment	65%
At risk for language impairment	7%
Ethnicity	
Not Hispanic/Latino	93%
Race	
White	50%
Asian	14%
White and Asian	14%
African American	7%
White and African American	7%
Other	7%

Measures

Language sample recording. An approximately 10-minute language sample was video-recorded (mean= 10m:41s, SD= 2m:33s, range= 10m:42s) for each participant. Two developmentally appropriate sets of toys were used to elicit the language sample (shopping bag with play food items; a picnic set with hamburgers, hotdogs, plates, utensils, napkins). Language samples were largely child-directed; clinicians used language facilitation techniques to elicit communication. All variables extracted from the language sample were calculated as ratios or proportions to account for minor variability in the length of the sample.

Communication partner standardization. Given that the participants in this study interacted with trained clinicians, communication partners were considered to be standardized for the purposes of this study. Each language sample was elicited by one of four trained clinicians. All clinicians received direct training on language facilitation techniques and employed the

strategies outlined in Paul and Norbury (2012). These facilitation techniques included, but were not limited to, sound play, self-talk, expansion, sentence cloze, and conversational starters; see Appendix A for full list and descriptions. Clinicians were instructed to provide the most facilitative language elicitation environment for the participants in order to acquire a robust language sample.

Standardization was confirmed by calculating clinician MLU as well as frequency and type of language facilitation techniques employed during each language sample. The examiners' average MLU was 4.20 (SD=0.63, range= 2.18). Examiners, on average, employed 10.42 strategies per minute (SD= 1.73, range= 5.1). The small magnitude of variability demonstrates that examiners remained relatively consistent in the frequency and distribution of strategies, regardless of the child. See Appendix B for the total distribution of language facilitation techniques employed by this investigation's examiners across participants.

Whereas these data are informative about the relative distribution of techniques used by trained clinicians in the present study, there is no existing evidence that allows for comparison. Despite the field's reliance on language sample elicitation and analysis for evaluation and treatment planning, a thorough review of the literature did not reveal any previous attempts to characterize or explore the relative rates and/or effectiveness of language facilitation techniques utilized by trained professionals. Further investigation in this area may uncover interesting results and guide future recommendations and training for language sample elicitation procedures for speech-language pathologists. Nevertheless, patterns observed across these data support the assumption that clinicians in the present study are relatively standardized communication partners that provided a optimal language elicitation environment.

Language outcome measures.

QUILS. Each participant completed the QUILS (Golinkoff et al., 2017), a computerized language assessment tool that examines receptive language across three areas: vocabulary, grammar, and fast mapping. The QUILS provides standard scores normalized to the bell-shaped distribution in the population (mean= 100, SD= 15) for each of the three component areas (Golinkoff et al., 2017). Children completed the QUILS assessment on a touch-screen device that provided auditory choices through a central speaker. Clinicians were instructed to provide assistance as necessary if participants required additional support for training to task and/or maintaining attention.

Preschool Language Scales-5 (*PLS-5*). All participants completed the auditory comprehension (AC) subtest of the PLS-5 (Zimmerman, Steiner, & Pond, 2011). The PLS-5 was administered and scored by trained clinicians per standardized protocol.

Language sample analysis. Undergraduate and graduate speech and hearing sciences students independently transcribed and coded each language sample using Systematic Analysis of Language Transcripts (SALT; Miller, & Iglesias, 2012) conventions. Transcribers completed computer-based training in SALT transcription and conventions. Samples were transcribed twice by separate raters to determine reliability. Transcription reliability was calculated by dividing the total number of differences at the word level (additions, omissions, substitutions) across transcripts of each sample by the total number of words in the master transcript. Through this method, inter-rater reliability was calculated to be 96%. Language samples were analyzed using SALT software and the following variables were calculated for each participant: mean length of utterance in morphemes (MLU), number of different words (NDW) per minute, and number of total words (NTW) per minute.

Joint engagement rating items. Two trained raters independently coded the behaviors in the language sample video clips. Each rater was randomly assigned half of the sample to code. To monitor agreement, 36% (5/14) of the sample was coded by both raters. Raters were not informed which portion of their sample was double-coded. Double-rated items were assessed for agreement, defined as a rating within one point on the seven-point continuum. Raters then participated in a retraining session to reconcile differences between items that were not in agreement. Examiners re-coded the remainder of their respective samples after this retraining session.

This investigation included three rating items to characterize joint engagement behaviors within dyadic interactions. Items were adopted from the Joint Engagement Rating Inventory (JERI) technical report by Adamson, Bakeman, and Suma (2016). These behaviors were rated along a seven-point continuum. Refer to the JERI technical report for more information on specific coding guidelines. Operational definitions and anchor scores for each joint engagement rating item are included in Appendix C. See Appendix D for sample rating form.

Data Analysis

Preliminary analyses examined patterns of joint engagement behaviors using descriptive statistics for both joint engagement ratings and language measures. To test for associations between joint engagement rating items (JE, SIJE, FC), partial correlations controlling for age were conducted. Analyses of variance (ANOVAs) were used to test for group differences in patterns of dyadic behaviors based on diagnostic subgroup (presence or absence of ASD).

For Research Question 2, bivariate Pearson correlational analyses were conducted to evaluate the relation between joint engagement rating items and performance on language measures in all participants. To further investigate how joint engagement behaviors may

uniquely contribute to language outcomes, they were entered sequentially in a hierarchical linear regression.

Results

Descriptive Statistics

Descriptive statistics were used to answer RQ1, which sought to identify what patterns of joint engagement behaviors, if any, do preschoolers with LI exhibit within a dyadic interaction.

Joint engagement rating items. Joint engagement ratings were spread across the seven-point continuum for all measures. Means for each category were close to the median rating along the continuum, 4, demonstrating adequate variability among ratings across participants. Descriptive statistics of joint engagement rating items are included in Table 2 below.

Table 2
Descriptive Statistics of Joint Engagement Rating Items

Measure	Mean	SD	Range (min-max)
JE	4.21	1.63	2-7
SIJE	3.64	1.34	2-6
FC	4.07	1.14	2-6

Language measures. Descriptive statistics for language measures were also conducted in the interest of analysis and subsequent correlations. These statistics revealed high variability in the language skills of participants. Across all standardized language measures, the sample as a whole scored more than one standard deviation below the normal range. See Table 3 for information on performance on standardized language measures. Upon closer examination of each participant's individual language profile, however, it becomes clear that there is substantial variability in the relative strengths and weaknesses of each child. Descriptive statistics of language sample measures separated by age group with available normative scores are included

in Table 4 below. Because NDW and NTW were calculated per minute in order to account for effects of sample length, there are no normative scores available for these data.

Table 3
Descriptive Statistics of Standardized Language Measures

Measure	Mean	SD	Range
QUILS Vocabulary	81.64	16.73	49
QUILS Grammar	84.29	13.77	43
QUILS Process	79.64	11.18	33
PLS-5 AC	76.07	12.05	42

Table 4
Descriptive Statistics of Language Sample Measures by Age Group

Measure	Mean	SD	Range	Standard Mean (SD)[a]
3;0-3;11 (n=2)				
MLU	1.91	1.21	1.71	3.35 (0.65)
NDW per minute	4.59	3.91	5.53	-
NTW per minute	11.47	8.84	12.49	-
4;0-4;11 (n=8)				
MLU	1.99	0.82	2.63	4.1 (0.60)
NDW per minute	5.38	3.42	10.03	-
NTW per minute	12.51	10.34	31.63	-
5;0-5;11 (n=4)				
MLU	2.88	1.27	2.87	5.4 (1.4)
NDW per minute	7.38	4.3	10.11	-
NTW per minute	23.38	15.24	35.46	-

[a]*MLU standard norms reported in Paul & Norbury (2012).*

Correlations

We used bivariate Pearson correlational analyses to probe RQ2, how patterns of joint engagement behaviors within dyadic interactions are related to performance on measures of language products and processes (i.e., vocabulary, grammar, word learning) in preschoolers with LI. Refer to Table 5 for correlation matrix.

JE was significantly correlated to measures of receptive language, including PLS-5 AC and QUILS Vocabulary measures. SIJE was significantly correlated with PLS-5 AC, MLU, NDW per minute, and NTW per minute. FC was significantly correlated with measures of language expression, specifically NDW per minute, NTW per minute, and MLU. SIJE and FC

were the only joint engagement rating items that were significantly correlated with each other, and this correlation remained after controlling for age $r(14)= .698$, $p=0.008$.

Correlational analyses of the relationships between language measures revealed QUILS grammar and PLS-5 AC score were significantly correlated. As would be expected, it was observed that MLU was correlated with NDW per minute and NTW per minute. This significance remained after controlling for age for both measures; NDW per minute, $r(14)= .793$, $p=0.001$; NTW per minute, $r(14)= .829$, $p=0.000$. MLU was also significantly correlated with PLS-5 AC score when controlling for age, $r(14)= 0.619$, $p=0.024$. Interestingly, MLU was significantly negatively correlated to QUILS Process scores, $r(14)= -.550$, $p=0.041$. This was an unexpected finding and will be further explored in the discussion.

Table 5
Correlation Matrix for Language and Joint Engagement Rating Measures

		1	2	3	4	5	6	7	8	9	10
1	MLU	-	0.165	0.132	-0.267	**-.550***	0.167	**.671****	**.651***	**.842****	**.876****
2	PLS-5 AC		-	0.495	**.616***	0.357	**.600***	**.565***	0.285	0.280	0.139
3	QUILS Vocabulary			-	0.314	0.068	**.781****	0.434	0.404	0.028	-0.042
4	QUILS Grammar				-	0.369	0.324	0.039	-0.041	-0.190	-0.247
5	QUILS Process					-	0.237	-0.153	-0.137	-0.250	-0.346
6	JE						-	0.357	0.281	0.210	0.145
7	SIJE							-	**.724****	**.701****	**.593***
8	FC								-	**.744***	**.701***
9	NDW per minute									-	**.959****
10	NTW per minute										-

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Given the dynamic nature of dyadic interactions, we were curious to see if examiner characteristics impacted the participant's performance during language samples. Correlational analyses revealed that examiner MLU was not significantly correlated with participant MLU, NDW per minute, or NTW per minute. These data evince that the examiners remained relatively consistent in regards to their own expressive grammar, and were uniform in adjusting their expression to effectively elicit language samples from participants.

Linear regression. Hierarchical linear regression was conducted to further investigate the influence of joint engagement behaviors on language skill. SIJE and FC were the only variables included in this analysis, given their relatively strong correlations with language measures. SIJE was found to be a significant predictor of both PLS-5 AC scores and MLU; FC was not a predictor of either language outcome, even when it was entered into the model first. Significant data are reported in Table 6 below.

Table 6
Hierarchical Regression Analysis of SIJE

Variable	Standardized coefficient, β	Significance, p
PLS-5 AC	0.565	0.035
MLU	0.671	0.009

ASD Subgroup

Albeit small, the binary diagnostic groups (LI -/+ ASD) did not differ significantly by age, and subgroup analyses were conducted to determine if patterns arose based on diagnosis. See Tables 7 and 8 for descriptive statistics for binary diagnostic groups. A one way analysis of variance (ANOVA) was conducted to compare the effect of ASD diagnosis on joint engagement ratings and language measures. It revealed significant group differences only in QUILS Grammar scores, $F(1, 12)= 5.74$, $p=0.034$.

Table 7
Descriptive Statistics for Joint Engagement Rating Items by Binary Diagnostic Subgroups

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
						Lower Bound	Upper Bound
JE	LI - ASD	6	4.67	1.862	0.760	2.71	6.62
	LI + ASD	8	3.88	1.458	0.515	2.66	5.09
	Total	14	4.21	1.626	0.434	3.28	5.15
SIJE	LI - ASD	6	3.50	1.761	0.719	1.65	5.35
	LI + ASD	8	3.75	1.035	0.366	2.88	4.62
	Total	14	3.64	1.336	0.357	2.87	4.41
FC	LI - ASD	6	3.83	1.329	0.543	2.44	5.23
	LI + ASD	8	4.25	1.035	0.366	3.38	5.12
	Total	14	4.07	1.141	0.305	3.41	4.73

Table 8
Descriptive Statistics for Language Measures by Binary Diagnostic Subgroups

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
						Lower Bound	Upper Bound
MLU	LI - ASD	6	1.90	1.05	0.43	0.80	3.01
	LI + ASD	8	2.48	0.97	0.34	1.67	3.29
	Total	14	2.23	1.01	0.27	1.65	2.82
PLS AC	LI - ASD	6	76.33	15.475	6.318	60.09	92.57
	LI + ASD	8	75.88	9.935	3.512	67.57	84.18
	Total	14	76.07	12.054	3.222	69.11	83.03
QUILS Vocabulary	LI - ASD	6	86.67	17.420	7.112	68.39	104.95
	LI + ASD	8	77.88	16.278	5.755	64.27	91.48
	Total	14	81.64	16.727	4.470	71.99	91.30
QUILS Grammar	LI - ASD	6	93.00	13.667	5.580	78.66	107.34
	LI + ASD	8	77.75	10.236	3.619	69.19	86.31
	Total	14	84.29	13.770	3.680	76.34	92.24
QUILS Process	LI - ASD	6	82.83	11.197	4.571	71.08	94.58
	LI + ASD	8	77.25	11.285	3.990	67.82	86.68
	Total	14	79.64	11.181	2.988	73.19	86.10
NDW per minute	LI - ASD	6	4.2840	3.38229	1.42576	0.7142	8.0443
	LI + ASD	8	7.0067	3.46784	1.17014	3.0948	8.6287
	Total	14	5.8398	3.58197	0.89318	3.2968	7.1560
NTW per minute	LI - ASD	6	10.1020	9.31891	4.52953	-0.1725	23.1146
	LI + ASD	8	19.4857	12.75472	3.90961	7.3551	25.8446
	Total	14	15.4641	12.00927	2.92925	8.0735	20.7300

Discussion

Summary and Implications

It is well-established that early language development occurs within the context of dyadic interactions in infants and toddlers. This phenomenon has received little attention as children age, however; it is unlikely that this complex relationship between dyadic interactions and language skills ceases to remain impactful once a child enters preschool. The primary purpose of this study was to extend this area of study to preschoolers with LI and explore potential patterns of joint engagement behaviors in this population. A second, and related question, asked if joint

engagement behaviors were significantly related to receptive and expressive language products and processes.

Patterns of joint engagement behaviors (RQ1). Consistent with our prediction, a high degree of variability was observed across individual joint engagement profiles. Yet, the sample of children with LI as a whole were rated at the midpoint along the rating scale used for all three joint engagement rating items. These midpoint scores exhibited by the sample can be translated to a generalized description of what dyadic interactions in preschoolers with LI looked like: the dyad was jointly engaged about one half of the session, the child incorporated symbols (either verbal or non-verbal) in joint engagement states about one third of the session, and the interaction lacked smoothness and/or was largely dominated by one partner (i.e., the examiner). The paucity of previous investigations with similar foci to those of the present investigation makes comparison to our sample difficult. Yet, there is evidence of significant differences in joint engagement behaviors between typically developing and developmentally disordered toddlers (Adamson et al., 2009; 2010). Considering this previous evidence, combined with the relatively low ratings of JE, SIJE, and FC observed in this investigation, it is plausible that the present sample would perform significantly below a comparison sample of age-matched typically developing peers. Future research with a control group is warranted.

Contrary to our hypothesis that children with LI may compensate for language difficulties with non-verbal means of communication to uphold the dyadic interaction, the sample received the lowest ratings on measures of SIJE. Current data on the development of SIJE in typically developing children suggest that this skill is stabilized between the ages of 30 and 42 months (Adamson et al., 2014). Our data suggest this skill was a challenge for our sample. It is possible the presence of a LI may play a role in reduced rates of symbol use in dyadic interactions. This

explanation parallels previous findings that children with LI engage in symbolic play less frequently than their typically developing peers (Casby, 1997). Adamson and colleagues (2009) found dramatic variability in the overall developmental trajectory of SIJE in both typically developing toddlers and those with developmental disabilities. They hint at the likelihood that an underlying "symbol-mindedness" is required prior to the infusion of symbols during joint engagement states. This line of research, as applied specifically to children with LI, is a potentially rich area of future study.

Relationship between joint engagement behaviors and language measures (RQ2). Total JE was significantly related to measures of receptive language, specifically receptive vocabulary. There are multiple possible justifications for this finding. One such explanation is the fact that an increased aptitude for JE allows for an increased number of opportunities to be exposed to novel words and concepts, thus resulting in an increased receptive vocabulary. However, in order for that hypothesis to be supported, we would also expect a significant positive correlation between JE and QUILS Process scores, a relationship not observed in the present study. Perhaps a more complete explanation of the relationship between joint engagement behaviors and language skill lies in the symbolic form of JE, SIJE.

Our study's findings indicate a clear correlation between SIJE and receptive and expressive language measures. This is consistent with previous studies that confirmed this relationship up to 36 months (Conway et al., 2018b; Hirsh-Pasek et al., 2015). However, considering our findings remained significant after controlling for age (up to 5;9, or 69 months), our data contradict Conway et al.'s claims that SIJE is no longer associated with language skills at 48 months.

Additionally, hierarchical regression revealed SIJE is a significant predictor of PLS-5 AC scores and MLU. This is consistent with Adamson et al.'s (2009) findings that SIJE strongly accounted for variability in standardized measures of receptive and expressive vocabulary across ASD, Down Syndrome, and typically developing diagnostic groups. It is important to continue to explore possible underlying mechanisms of this seemingly consistent and powerful relationship between SIJE and language performance, as it may have implications for language assessment and intervention in preschoolers with LI.

Our data demonstrate FC is significantly correlated with measures of expressive language. Previous literature has supported the importance of FC in language skills within mother-toddler dyads (Conway et al., 2018a; Smith et al., 2017). Our findings confirm this relationship and introduce the idea that it extends beyond the mother-toddler dyad, remaining influential in dyadic interactions involving preschoolers with LI. Moreover, Hirsh-Pasek et al. (2015) found not only clear evidence that FC was strongly correlated with measures of language expression, but also that it was the strongest predictor for expressive language performance over other language measures and joint engagement rating items. Unlike Hirsh-Pasek et al., we did not find that FC, either alone or after accounting for SIJE, possessed significant predictive strength. Regardless of predictive potential, our evidence is consistent with previous claims that FC is paramount in dyadic interactions and the development of expressive language skills.

Of the three joint engagement rating measures, SIJE and FC were significantly correlated with each other, whereas total JE was not significantly correlated with either of the other two measures. This correlation between SIJE and FC has previously been observed by Hirsh-Pasek et al. (2015). These data, combined with the data that demonstrates correlations between joint engagement rating items and language measures, support the importance of considering SIJE and

FC over total JE. SIJE and FC were both highly correlated with measures of expressive language, and SIJE was even found to be a significant predictor of performance on language measures. It seems it would be more informative to expend resources gathering information regarding SIJE and FC over total JE. This is consistent with the focus current literature as well; very little research examines total JE independently, yet there are numerous studies examining SIJE and FC specifically (Adamson et al., 2004; 2014; Conway et al., 2018a; Hirsh-Pasek at al., 2015).

MLU and QUILS Process. We were surprised that our data revealed a significant negative correlation between MLU and QUILS Process scores. One way this correlation can be interpreted is that participants who scored higher on measures of lexical acquisition exhibited a significantly lower MLU. The children in our sample had stronger receptive lexical skills than expressive grammar skills. There is roughly related evidence to this idea. In a longitudinal study of lexical and grammatical development in typically developing and late-talking toddlers, researchers found evidence of an imbalance between late-talking toddlers' use of syntactic and lexical bootstrapping (Moyle, Weismer, Evans, & Lindstrom, 2007). They found that late-talking toddlers did not demonstrate the bi-directional bootstrapping that typically developing toddlers relied on, resulting in a one-sided reliance on lexical bootstrapping. This relative strength in lexical skills occurred in stark contrast to a deficit in grammatical (or expressive syntactic) skill observed in the study's results. Our findings are in accordance with Moyle et al.'s findings, as well as previous research (Paul, 1993), suggesting that children with LI (or in the case of Moyle et al., 2007, language delay) may have an imbalance in lexical and grammatical skills that is observed through a relative weakness in expressive syntax.

We can also consider this correlation in the reverse, in the terms of participants who demonstrated stronger expressive language skills scored lower on measures of receptive lexical acquisition. There is very little evidence that examines the relative strengths and weaknesses in receptive and expressive language skills in children with LI; yet, there is a great debate among the field regarding this split in children with ASD. The evidence has been highly contradictory. There is extensive anecdotal and research-based evidence that children with ASD are typically stronger in receptive than expressive measures (Hudry et al., 2010; Mitchell, Cardy, & Zwaigenbaum, 2011; Volden et al., 2011), yet other evidence states the contrary (Weismer, Lord, & Esler, 2010), and other evidence argues that neither of these theories are representative of the population of children with ASD (Kwok, Brown, Smyth, & Cardy, 2015; Luyster, Kadlec, Carter, & Tager-Flusberg, 2008). All of this uncertainty and debate further supports the importance of considering each child's individual language profile when making clinical decisions in the assessment and intervention of children with LI.

Language profiles. Of note, visual analysis revealed that each participant in this study presented with a distinct language profile with relative strengths and weaknesses across areas of receptive and expressive language, specifically observed with QUILS subtest scores. Although not a primary focus of the present investigation, consideration of this observed variability in language profiles highlights an important clinical consideration in the screening and/or assessment of children with LI: we must consider the complete language profile, including language learning processes. Specifically, these data provide further evidence supporting the theory that an emerging dimensionality of language ability exists in preschoolers, investigated previously by Tomblin and Zhang (2006) and Language and Reading Research Consortium (2015). These findings are consistent with previous research that emphasizes the importance of

considering a child's skills across language domains, both in terms of products and processes, in order to accurately identify children with LI (Van Weerdenburg, Verhoeven, & Van Balkom, 2006; Weismer & Evans, 2002; White, Alexander, & Greenfield, 2017). It would be potentially detrimental to base judgments on a child's language skill solely based on one area of the entire language system.

This argument is further supported when we examine the sensitivity of the QUILS screener in the identification of LI in our sample. Using an empirically derived cut-off score of 88 (the low end of the average range), we capture all of our participants with LI (100%) if we consider each score in any one subtest as a diagnostic indicator in the language profile (i.e., if a child had a score of 88 or below in any one of the three subtests). However, if we only consider a child's QUILS vocabulary score, the sensitivity is 57%. If only QUILS grammar is considered, the sensitivity is 79%, and similarly, if only QUILS process is considered, the sensitivity is 79%. We would not identify all of the children with LI if we did not take into account the complete language profile.

ASD subgroup. Although subgroup analyses (LI -/+ ASD) revealed few significant differences between joint engagement ratings and language measures, there are observable trends in descriptive data both within and between the two groups. The groups slightly, but not significantly, differed in mean joint engagement ratings, all of which fell within the 3 and 4 ratings. The LI + ASD subgroup performed better on measures of SIJE and FC, but not total JE. This is an interesting trend considering the symbolic and social factors, both of which are commonly impaired in ASD (Jarrold, Boucher, & Smith, 1993), that contribute to SIJE and FC ratings. The first plausible explanation would be the potential impact of age differences between groups, yet it has already been established that the groups did not differ significantly in age. An

alternative, and likely, rationalization is the fact that the LI - ASD subgroup presented with a lower mean MLU (1.90) than the LI + ASD subgroup (2.48). Here we reiterate the significant correlation between MLU and SIJE and FC observed in the sample as a whole. Although the MLU between groups did not differ significantly in the one-way ANOVA, it seems the trend of this correlation remained influential even when the sample was divided into diagnostic subgroups.

It is also possible that the LI + ASD subgroup has received intervention that targets these joint engagement behaviors. Review of available IEP goals confirmed that the majority of participants in the LI + ASD subgroup were receiving intervention for skills related to joint engagement, such as taking conversational turns and orienting and attending to communication partners. Yet, many of these participants also had goals related to expanding MLU, so it is difficult to attribute one intervention target to their significantly higher SIJE and FC ratings. Nonetheless, it is still interesting to consider possible effects of previous joint engagement intervention on performance.

Both subgroups performed below normal limits on standardized measures of language, with the exception of QUILS Grammar. The LI - ASD subgroup scored within normal limits on the QUILS Grammar subtest, but the LI + ASD subgroup performed below normal limits; this was the only significant difference between groups highlighted by the one-way ANOVA. This finding is similar to the results reported in a 2011 study by Volden et al. that found preschoolers with ASD demonstrated weaker receptive language skills when compared to expressive language skills. It is interesting to observe this relative weakness in receptive language skills emerge in the context of this sample as well. However, as mentioned above, there is a debate in the field among

researchers and professionals alike as to whether or not this is a valid assumption for this population.

In an effort to further characterize the language profiles of the diagnostic subgroups in this study, participants were categorized into three groups: those identified by the QUILS screener at the low end of the average range (using a standard score of 88 as the empirically derived cut-off score explained above) in one, two, or three QUILS subtest areas. Of our 14 participants, 29% scored at or below the cut-off score in one subtest area, 29% in two subtest areas, and 42% in three. It appeared, however, that the majority of participants with ASD presented with deficits in at least two subtest areas, leading to the question: are scores below the cut-off on at least two QUILS subtests an indicator of a broad language impairment characteristic of LI in children diagnosed with ASD? This was tested using sensitivity and specificity calculations that revealed a sensitivity of 86% and a specificity of 43%. This analysis, although not the most specific measure, again highlights the importance of considering language profiles and hints at a potential pattern in skills across diagnostic categories.

As a whole, these subgroup analyses introduce potential observable differences in dyadic interactions when comparing children with LI and children with LI and concomitant ASD. With a larger sample, it is possible that significant group differences would emerge and discernible patterns would be revealed.

Limitations and Future Directions

The present study served as an initial foray into the analysis of joint engagement behaviors as they relate to language measures in preschoolers with LIs. Our results indicate promise in this area for future study. However, the present study's findings are limited by

specific aspects of its design and special considerations should be taken into account in the future.

Most notably, the sample population was relatively small and heterogeneous because the participants and subsequent language samples were not recruited for the specific purpose of this study. There was considerable variability in the group in terms of diagnosis, language characteristics, age, and other demographics. Furthermore, because this sample was gathered prior to the onset of the current investigation, we have incomplete information regarding previous and ongoing intervention that our participants received. It is possible that earlier therapy targeted the outcome measures we used.

The small sample size precluded between-age-group analyses and proper comparison to a typically developing matched sample. Future study of joint engagement behaviors should be extended to larger, more homogenous samples of children with LI, as well as a typically developing sample of preschoolers to allow for comparison between groups. Considering the initial findings from the between-diagnostic subgroup analyses, replication of this study with larger diagnostic subgroups may shed light on interesting observations between children with LI and children with LI and concomitant ASD.

Limitations can also be observed in the outcome measures used. Although previously proven to be a valid measure of characterizing joint engagement behaviors within interactions (Adamson et al., 2012), the use of joint engagement rating items in the present study was implemented outside of the established protocol. It is unclear if the validity of this measure remains when applied beyond the context of the Communication Play Protocol (Adamson et al., 2009). What's more, our primary measures of expressive language (MLU, NDW per minute, NTW per minute) were not standardized, impacting the strength, validity, and generalizability of

our findings. Future research in this domain should follow the Communication Play Protocol and/or include more standardized expressive language outcome measures.

Application of this method of research to peer interactions in preschool may also serve as a potentially revealing future area of study. Preschoolers often engage in sustained dyadic interactions with their peers, yet there has been surprisingly little focus on the potential impacts of these peer-to-peer joint engagement interactions on language development (Mashburn, Justice, Downer, & Pianta, 2018). Schechter and Bye (2007) found that children's language development was facilitated by peers in mixed-income preschool classrooms; children of low-income households demonstrated significant improvements in language measures after being integrated with children of mid- and upper-income families. The authors reason that more-affluent peers may provide their classmates with a greater quantity and quality of language models that facilitate language development. A more recent study by Mashburn and colleagues also found the expressive language abilities of peers contributed to language development in preschoolers. This evidence describes an interesting and extremely relevant phenomenon: peer interactions are directly related to language development in preschoolers. It would be interesting to consider this phenomenon through the lens of joint engagement behaviors.

Additionally, as with any research in the field of speech-language pathology, an appropriate next step would be to examine the potential impact of joint engagement-based interventions on language outcomes in children with LI. Given the significance of SIJE and FC, these would be promising areas of focus. The findings in this study provide initial evidence suggesting that this line of research has the potential to broaden the scope of future language interventions for preschoolers with LI.

Conclusion

The present study provides significant contributions to the growing body of literature examining joint engagement behaviors in young children. Our data confirm previous evidence regarding the significance of SIJE and FC in language outcomes and extend these findings to our sample population of preschoolers with LI. We also highlight the importance of considering a child's joint engagement and language skills across domains, considering the child's complete profile. Future research should continue to investigate these joint engagement behaviors in larger, more homogenous samples to continue to inform assessment and intervention recommendations for children with LI.

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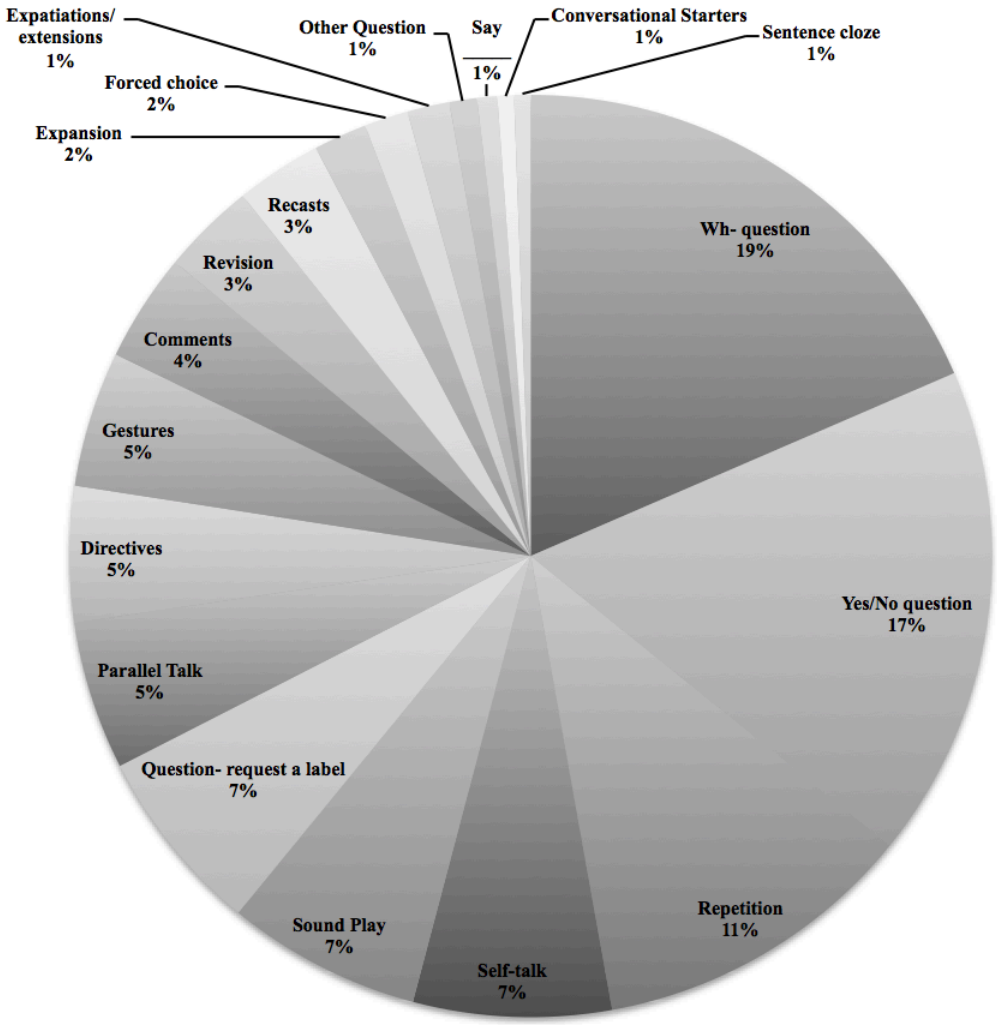
Appendix A
Language Facilitation Techniques

Strategy	*Definition*	*Example*
Sound play	Producing sounds for items in the environment and repeating or playing with the sounds children say	"Vroom," "beep"
Gestures	Moving body or face to reinforce message communicating with word	Smile, waving hi, exaggerated facial expression to indicate surprise
Self-talk	Telling child what you are doing, seeing, or feeling at the time it is happening	"I am cutting the apple"
Parallel Talk	Providing self-talk for the child	"You are making the hot dog"
Repetition	Repeating what the child says while looking at them	Child: "I am hungry" Adult: "You are hungry"
Revision	Revising what the child says by changing the words to make the utterance more appropriate for the situation	Child: "I eated it" Adult: "You ate it"
Expansion	Revising what the child says by adding words to make the utterance more complex	Child: "I ate it" Adult: "You ate the red apple"
Expatiations/extensions	Adding information to the child's utterance	Child: "I ate it" Adult: "You ate it. You must be hungry"
Recasts	Changing the child's utterance into a different type of sentence	Child: "More bubbles" Adult: "You want more bubbles?"
Sentence cloze	Providing child an opportunity to complete your statement or idea	"The cow jumped over the _____ [moon]"
Say _____	Providing the child with a direct model	"Say ball"
Forced choice	Providing the child with two choices	"Ketchup or mustard on your hot dog"
Wh- question	Asking a child a wh- question to elicit conversation	"Where is the grill?"
Question- request a label	Eliciting the label of an object through a question	"What's this?"
Yes/No question	Asking the child a question that only requires a yes or no response	"Do you like bananas?"
Comments	Providing comments about what is observed in the environment	"Wow that is a special toy you brought with you"
Directives	Providing child with direction to guide interaction	"Grill the hotdog"
Conversational Starters	Use utterances that start with phrases to tempt the child to talk about topics	"I wonder what goes on a hotdog"

Adapted from Paul and Norbury (2012).

Appendix B

Distribution of Language Facilitation Strategies



Appendix C

Joint Engagement Rating Items

Joint engagement. The present investigation defined a joint engagement state as a period of 3 or more seconds in which the child and communication partner are engaged in a shared activity (Adamson et al., 2016). This rating focused exclusively on time spent in joint engagement states throughout the language sample, quality of engagement was not a factor considered. Anchor scores are described below:

1= No episodes of the joint engagement state

4= In joint engagement for approximately half of the scene (displays several brief or a few relatively sustained episodes)

7= Almost always in the joint engagement state

Symbol-infused joint engagement. This study described SIJE as a state in which the dyad is jointly engaged in a symbolic interaction. Scores were measured primarily based on the amount of time, but the final rating was adjusted either higher or lower depending on the quality of the child's symbolic interaction. A symbol can be either verbal or nonverbal. Anchor scores are described below:

1= No episodes of the SIJE state

4= Spends about a third of the scene in SIJE that is of moderate quality, briefly in SIJE in a strikingly high quality manner

7= Frequently in rich and varied episodes of SIJE

Fluency and connectedness. The present study adopted Hirsh-Pasek et al.'s (2015) definition of FC: the overall flow and cohesion of a dyadic interaction. Indicators of FC include balance between each partner's contributions, frequent and balanced turn-taking, and overall

fluid progression through the conversation. FC of the interaction may be sustained by either verbal and/or nonverbal communication methods (Adamson et al., 2016). Anchor scores are described below:

1= No interaction is established

4= Interaction lacks smoothness, appears to be largely dominated by one partner

7= Fluid and balanced interaction that is often sustained

Appendix D

Rating Form

Participant #:				Rater:		Date:	
Overall Joint Engagement	1 None	2	3	4 Engaged half of the session	5	6	7 Almost always
Symbol-Infused Joint Engagement	1 None	2	3	4 Engaged a third of the session	5	6	7 Frequent, high quality
Fluency and Connectedness	1 None	2	3	4 Lacks smoothness; dominated by one partner	5	6	7 Fluid, balanced interaction
Notes							