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Children's Individual Language Experiences: A Multilevel Analysis of Language Use in Head Start Classrooms

Author
Blackstock-Bernstein, Anne

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Children's Individual Language Experiences:

A Multilevel Analysis of Language Use in Head Start Classrooms

A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Philosophy in Education

by

Anne Blackstock-Bernstein

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ABSTRACT OF THE DISSERTATION

Children's Individual Language Experiences:

A Multilevel Analysis of Language Use in Head Start Classrooms

by

Anne Blackstock-Bernstein

Doctor of Philosophy in Education

University of California, Los Angeles, 2019

Professor Alison Bailey, Chair

Preschool settings promote children's language development and have the potential to reduce achievement gaps, especially for children from low-income backgrounds. These benefits are driven by the interactions children have with their teachers and peers, but recent evidence suggests there is variability in the quality and quantity of individual children's classroom language interactions. Using a sample of Spanish-English dual language learner and monolingual English-speaking children (n = 117) enrolled in 21 Head Start preschool classrooms, this study investigated whether variation in individual children's classroom language use and exposure was related to their characteristics. Direct assessments of children's English and Spanish language proficiency and parent and teacher ratings of shyness and inhibitory control were used as predictors, along with gender, age, and disability status. Classroom observations using the Language Interaction Snapshot (LISn) examined each child's teacher-child and peer interactions.

Multilevel regression analyses identified several important child-level differences in the frequency and type of language used by children and teachers in the classroom. In classrooms with lower instructional support, as measured by the Classroom Assessment Scoring System (CLASS), shy children talked less to their teachers than their more extroverted peers did; however, in classrooms with more instructional support, there was no effect of shyness on children's language use. Children with higher inhibitory control talked less to their teachers than did children with lower inhibitory control, but they experienced more teacher elaboration. Teachers used contextualized language more often with children who demonstrated lower English proficiency than with children who demonstrated higher English proficiency. Girls had more than twice as many sustained conversations with their peers than boys. Children with disabilities had conversations with their teachers at half the rate of their peers. There were positive associations among three indicators of high-quality teaching: the frequency of children's talk to teachers, teachers reading aloud to children, and ratings of classroom instructional support. This study's findings have implications for professional development and measurement of preschool teachers' instructional practices with individual children, especially dual language learners.

The dissertation of Anne Blackstock-Bernstein is approved.

Jennie Katherine Grammer

Matthew Madison

Meredith Phillips

Alison Bailey, Committee Chair

University of California, Los Angeles

2019

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VITA

EDUCATION

University of California, Los Angeles, Graduate School of Education and Information Studies
M.A., Education: Human Development and Psychology 2014

Brandeis University, Waltham, MA
B.A., Triple Major: Psychology; Sociology; Education Studies 2009
Magna Cum Laude

SELECTED GRANTS, AWARDS, AND FELLOWSHIPS

2018-19	Dissertation Year Fellowship ($20,000 + tuition)
2018	*Language Learning* Dissertation Grant ($2,000)
2017	Society for the Psychological Study of Social Issues Grant-in-Aid ($1,722)
2016	Prize in Memory of Leigh Burstein ($1,000)
2016	Poster Award at UCLA Research & Inquiry Conference ($200)
2014	Merlin C. Wittrock Fellowship ($1,800)
2013, 2014	Graduate Summer Research Mentorship ($6,000/year)
2012-15	William and Louise Lucio Fellowship ($30,000/year)

SELECTED PUBLICATIONS

Bailey, A. L. **Blackstock-Bernstein, A**. Ryan, E. & Pitsoulakis, D. (2016). Data mining with natural language processing and corpus linguistics: Unlocking access to school children's language in diverse contexts to improve instructional and assessment practices. In S. ElAtia, O. Zaiane and D. Ipperciel (Eds.), *Data Mining and Learning Analytics: Applications in Educational Research* (pp. 255–277). Malden, MA: Wiley-Blackwell.

Bailey, A. L. **Blackstock-Bernstein, A**., & Heritage, M. (2015). At the intersection of mathematics and language: Examining mathematical strategies and explanations by grade and English learner status. *Journal of Mathematical Behavior, 40(A)*, 6–28.

SELECTED CONFERENCE PRESENTATIONS

Blackstock-Bernstein, A. (2019, April). *Differences in Individual Children's Language Experiences in Head Start Classrooms*. Oral presentation at the annual meeting of the American Educational Research Association, Baltimore, MD.

Blackstock-Bernstein, A. (2019, March). *Teacher and Parent Ratings of Shyness and Effortful Control in Latinx Children in Head Start*. Poster presented at the annual meeting of the Society for Research on Child Development, Baltimore, MD.

Blackstock-Bernstein, A. & Bailey, A. (2017, April). *How Elementary Students Use Gesture to Enhance Verbal Meaning-Making in Procedural Mathematics Explanations*. Oral presentation at the annual meeting of the American Educational Research Association, San Antonio, TX.

Blackstock-Bernstein, A., Woodbridge, A., Chang, S., & Bailey, A. (2016, April). *Relating Mathematical Understanding to Oral Language Proficiency: Elementary Teachers' Ratings of Student Mathematical Explanations*. Oral presentation at the annual meeting of the American Educational Research Association, Washington, DC.

SELECTED RESEARCH EXPERIENCE

Center for Improving Child Care Quality (CICCQ), UCLA
Language and Literacy Consultant for UCLA Early Care and Education Centers 2018-2019
Data Manager 2016-2019

BEAR (Brain, Education, Affect, and Regulation) Lab, UCLA
Graduate Student Researcher 2014-2016

Dynamic Language Learning Progressions Project, UCLA
Senior Graduate Student Researcher 2012-2016

Neuroanesthesiology Lab, Weill Cornell Medical College
Research Study Coordinator, Anesthesiology Dept. 2009-2012

SELECTED TEACHING EXPERIENCE

Teaching Assistant/Associate, UCLA 2015-2017
- •EDUC 166: *Language, Literacy and Academic Development: Educational considerations for school-age multilingual and ELL students*
- •EDUC 187: *Cognitive Development in the School Context*
- •PSYC 134A: *Applied Developmental Psychology: Infant and Toddler Development and Care*
- •PSYC 134B: *Development, Education and Care of Preschool-age Children*

Graduate Writing Consultant, UCLA 2014-2019

SELECTED SERVICE AND PROFESSIONAL ACTIVITIES

Service to the University

2018-19	Faculty Search Committee (Education dept.), Member
2017-18	Leadership in Professional Development, Education Policy Workgroup Leader
2016-17	Graduate Students Association, Commissioner of Elections
2015-16	Graduate Students Association Education Council, Co-chair
2015-16	Executive Committee (Education dept.)
2014-16	Committee on Degrees and Academic Standards (Education dept.)

Service to the Field

2019-22	Los Angeles County Child Care Planning Committee, Member
2015-17	UCLA GSE&IS Research and Inquiry Conference, Reviewer
2014-17	Annual meeting of the American Educational Research Association, Reviewer
2014-15	*InterActions*, UCLA Journal of Education and Information Studies, Reviewer

Other Professional Experience

2013-16	KinderPrep and Elementary Tutor, Academic Achievers, Los Angeles, CA
2007-09	Infant/Toddler Teaching Assistant, Lemberg Children's Center, Waltham, MA
2007-09	Preschool Teaching Assistant, Waltham Family School, Waltham, MA
2007	Preschool Teacher, Aang Serian Peace Village NGO, Arusha, Tanzania

CERTIFICATIONS

2019-24	Child Development Site Supervisor Permit, CA Commission on Teacher Credentialing
2017-19	Infant & Pre-K CLASS Observer, Teachstone

CHAPTER 1

Introduction and Literature Review

Oral language proficiency is critical to academic success. Children's ability to understand what teachers and peers are saying, engage in discussions, pose questions, and articulate their own understanding is of foundational importance. The underlying oral language skills (e.g., vocabulary, syntax) that enable this classroom participation and support children's literacy begin to form in early childhood (Dickinson & McCabe, 2001), and variation in early oral language ability can lead to achievement gaps that persist throughout schooling (NICHD ECCRN, 2005). In the United States, these gaps are particularly large for children who speak a home language other than English (i.e., dual language learners or DLLs) and for children from low-income households.

Early care and education (ECE) can provide children with opportunities that promote their language development and reduce achievement gaps. Preschool teachers can improve children's later language outcomes by engaging them in extended back-and-forth conversations, asking them open-ended questions, and exposing them to sophisticated vocabulary (Dickinson & Porche, 2011; Pianta, Downer, & Hamre, 2016). When DLLs are enrolled in high-quality preschool programs, they make significant gains in language development, and they benefit more from increased time in these settings than their monolingual English-speaking peers (Yazejian, Bryant, Freel, & Burchinal, 2015). However, most preschool classrooms, particularly those serving children living in poverty, do not demonstrate high-quality teacher-child interactions (LoCasale-Crouch et al., 2007). Prior studies have shown that professional development can help preschool teachers enrich the quality of their interactions with children, thus improving children's language and preliteracy outcomes (e.g., Wasik & Hindman, 2011). Professional

development should aim to ensure that all children, especially DLLs and children from low-income households, have access to high-quality preschool classrooms that are equipped to support their language learning needs.

Researchers and policymakers define quality based on standardized measures, which examine the classroom experience on an aggregate level, paying little attention to how individual children's experiences might vary within a classroom (Burchinal, 2018). In order to better prepare ECE teachers to support children's individual language-learning needs, we need to understand how children's language experiences differ in the classroom and begin to investigate why these differences may occur.

This dissertation examines children's and teachers' classroom language use with a sample of DLL and non-DLL preschoolers from low-income households. I use classroom observations to describe the language interactions that occur between individual children and their teachers and to examine variability both within and across classrooms. I use parent/teacher questionnaires and child assessments to investigate how this variation is related to children's characteristics and overall, aggregate classroom quality. The findings will have implications for supporting preschool teachers in enriching the language environment for all students in their classrooms so that every child has equal access to language learning opportunities.

Literature Review

Importance of oral language development

In the first few years of life, children develop language skills that form the basis of their ability to communicate and interact with the world. As early as preschool, children's oral language skills are related to their concurrent emergent literacy and mathematics skills (Hindman, Skibbe, Miller, & Zimmerman, 2010; Storch & Whitehurst, 2002). These oral

language skills directly influence the development of code-related skills required for reading (e.g., print awareness, phonological awareness; Dickinson, McCabe, Anastasopoulos, Peisner-Feinberg, & Poe, 2003; NICHD ECCRN, 2005; Storch & Whitehurst, 2002). As a result, children's early oral language abilities are predictive of their literacy in elementary school (Dickinson & McCabe, 2001; Hulme, Nash, Gooch, Lervåg, & Snowling, 2015; Sénéchal & LeFevre, 2002; Storch & Whitehurst, 2002).

It is possible that the association between children's oral language and later literacy is even stronger than the existing evidence suggests. The vast majority of research on children's early language skills has used vocabulary as a proxy for overall oral language ability, in part due to the ease of measurement using a version of the Peabody Picture Vocabulary Test (e.g., PPVT-III; Dunn & Dunn, 1997). While vocabulary is an essential component of oral language development, it is only one piece of a larger puzzle. A meta-analysis of early literacy development by the National Early Literacy Panel (2008) revealed that composite measures of oral language, which evaluated children's syntax (i.e., sentence structure) and listening comprehension skills in addition to their vocabulary, were more predictive of later literacy skills than measures of vocabulary alone. Some researchers argue that if future studies view children's language through a comprehensive lens that encompasses these word-, sentence-, and discourse-level skills, we may reveal that children's oral language skills have a stronger influence on their later literacy (Dickinson & Tabors, 2001; Dickinson et al., 2003).

Factors that contribute to oral language development

Children's oral language skills develop primarily through their interactions with other people. As children are exposed to adult language throughout infancy and early childhood, they begin to acquire the vocabulary, syntax, and discourse structures of whatever languages they

hear. They use this growing knowledge to produce speech, and there is evidence that the amount of language children are exposed to in the first few years of life has implications for their expressive language learning. For example, children whose parents speak more words and who are engaged in more conversational turns (i.e., back-and-forth interactions) score better on measures of expressive language, including vocabulary (Gilkerson & Richards, 2008; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991). In part, benefits to children's vocabulary and syntactic development occur because of exposure to the varied vocabulary and complex syntax structures of adult oral language (Dickinson & Porche, 2011; Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010). Increased syntactic understanding aids in later reading comprehension as children encounter complex sentence structures.

Certain types of adult language are particularly useful for children's language development. For example, children benefit from hearing language that is abstract and removed from the immediate context, such as recalling an experience from the previous day (Dickinson & Tabors, 2001). Exposure to this type of abstract language—labeled by some scholars as decontextualized language[1]—helps prepare children to use the types of language often needed in school, such as predicting and reasoning (Massey, Pence, Justice, & Bowles, 2008). When engaging in decontextualized uses of language, children must convey novel information to an audience that may share only limited background knowledge with them. Their skill interpreting such information and engaging in decontextualized discourse is related to later reading comprehension (Snow, 1991). Most important, however, are children's opportunities to engage in sustained back-and-forth interactions with their caregivers. In these conversations, adult

[1] Recently the term "decontextualized" has been called into question, in part because all language is contextualized within its discourse community (Gee, 2014). Bailey (in press) has suggested the term "recontextualized" to capture the notion that the speaker takes an idea that is contextualized within her mind and inaccessible to the listener, and she uses language to "recontextualize" it for the listener's mind.

responses are contingent on the child's speech, which teaches the child about discourse patterns and helps build vocabulary (Roseberry, Hirsh-Pasek, & Golinkoff, 2014). In addition to increasing children's exposure to adult language, back-and-forth interactions provide children with repeated opportunities to speak and practice their expressive language skills. Children learn to clarify misunderstandings and negotiate meaning with their interlocutor(s). Studies have shown that children who experience more frequent teacher-child interactions see greater growth in their expressive language skills during preschool (Bratsch-Hines, Burchinal, Peisner-Feinberg, and Franco, 2019). Sheer volume of talk, however, is not the only feature of an optimal interaction. Adult-child interactions are especially beneficial for children's language development when they involve extended discourse on a single topic, which helps develop children's vocabulary and discourse skills (Dickinson & Tabors, 2001).

Children's interactions with peers are also important for their developing language skills. Dickinson (2001) found that as the amount of time children spent engaged in pretend play with peers during preschool increased, their performance on literacy outcomes during kindergarten improved. This academic improvement was directly related to the time spent talking with other children, thus indicating that verbal interactions with peers have a positive impact on language development (Dickinson, 2001). A large-scale, multi-state study found positive peer effects on preschool children's expressive and receptive language skills (Mashburn, Justice, Downer, & Pianta, 2009). Children whose classmates began preschool with higher expressive language abilities had greater expressive and receptive language growth throughout preschool.

Language development for children learning two languages

Children whose primary home language is different from their language of instruction benefit similarly from frequent exposure to rich adult language and extended interactions with

both adults and peers. In the United States, these children may be referred to as English language learners (ELLs), limited English proficient (LEP) students, emerging bilinguals, or dual language learners (DLLs), among other labels. In this dissertation, I will use the term dual language learners to describe these children, as they are developing skills in both their home language and English (i.e., their language of instruction) and may demonstrate varying degrees of English language proficiency.[2] Supporting the English language development of these children does not necessarily mean increasing their exposure to and usage of English. In fact, increasing a child's proficiency in their home language is an effective way to improve their English proficiency, because skills in both languages build on each other in an interdependent manner (August & Shanahan, 2006; Castilla, Restrepo & Perez-Leroux, 2009; McCabe et al., 2013). Even in studies that have not found a transfer of skills between languages, the use of children's home language in their classrooms was found to improve their home language development without impeding their English language development (Raikes et al., 2019).

There are several strategies that teachers can use in order to foster dual language development. For example, Gort and Pontier (2013) describe the flexible and strategic language used by preschool teachers in dual-language classrooms. They found that teachers scaffold children's emergent language skills by code-switching between Spanish and English, thus creating "safe spaces for students to adopt their emerging bilingual repertoire" (p. 240). Teachers can also support DLLs' vocabulary development by providing repeated, meaningful exposure to new words and encouraging children to talk about them (Wasik & Hindman, 2014). Teachers' use of contextualized language, which is related to the child's immediate context (e.g., labeling an illustration), is particularly important for DLLs' vocabulary learning (Hindman, Wasik, &

[2] The term dual language learner is used widely in the field of early childhood education and is preferred by the U.S. Departments of Health and Human Services and Education (US DHHS & ED, 2016).

Erhart, 2012). Several studies have also found that peer talk in the classroom is particularly helpful for DLLs' English language development. For Spanish-English DLL preschoolers and kindergarteners, the frequency of peer interactions in English is predictive of their expressive English language skills (Chesterfield, Chesterfield, & Chavez, 1982; Palermo et al., 2014; Rojas et al., 2016).

Role of ECE in children's language development

For decades, policymakers and politicians have recommended early care and education settings as a means to narrow the opportunity gap—and therefore the early language and literacy achievement gap—between children from different socioeconomic backgrounds. Head Start, for example, was created in 1965 with the goal of preparing preschool children from low-income backgrounds for elementary school (Puma et al., 2010). Studies show that high-quality early childcare programs can result in improvements in academic achievement for students, especially those from low socioeconomic status (SES) backgrounds (Mashburn et al., 2008; Peisner-Feinberg & Burchinal, 1997; Peisner-Feinberg et al., 2001; Ramey & Ramey, 2004). The definition of "high quality" and its corresponding measurement, however, are disputed (Burchinal, 2018; Pianta, Downer, & Hamre, 2016). Extensive research has attempted to identify the active ingredients of ECE and understand how they combine to promote optimal development for children. Of particular interest to the current study are findings that isolate how preschool can promote children's language and literacy skills.

In recent years, most researchers have agreed that teacher-child interactions and relationships have the greatest impact on student achievement (Burchinal, Vandergrift, Pianta, & Mashburn, 2010; Howes et al., 2008; Mashburn et al., 2008; Pianta et al., 2016; Sabol, Hong, Pianta, & Burchinal, 2013). Unsurprisingly, children's language learning can be supported

through the language interactions they have in the classroom. For example, in a recent study, Gámez, Neugebauer, Coyne, McCoach, and Ware (2017) found that kindergarten teachers' syntactic complexity during class time positively predicted spring expressive vocabulary scores of both their DLL and monolingual English-speaking students, after controlling for fall scores. When teachers and children are discussing new vocabulary terms, teachers' repetition of children's language is predictive of their vocabulary learning (Wasik & Hindman, 2014).

While ECE classrooms have the potential to provide opportunities for children to practice their language skills, studies have shown that high-quality teacher-child interactions do not typically occur in these settings. Instead, teacher talk is directive and interactions with students are infrequent (Kontos, 1999; Sylvester & Kragler, 2012). Children have few opportunities to respond to or elaborate on teachers' speech (Zill & Resnick, 2006). Numerous studies have shown that targeted support for children's language learning is minimal in preschool classrooms. In an investigation of literacy-based lessons in six Head Start classrooms serving large numbers of dual language learners, Jacoby and Lesaux (2014) found that only 22% of the 147 observed lessons fostered extended discourse. In a study of 72 classrooms serving low-income students, Sawyer and colleagues (2016) found that teachers used few linguistically responsive practices to support the DLL children in their classrooms. In a large randomized controlled trial of the effectiveness of Head Start, researchers found that students who attended Head Start performed better than those who did not on several school readiness measures, but Head Start had no impact on children's phonological processing and oral comprehension (Puma et al., 2010). These skills—which we know are essential for learning to read—are best developed through extended discourse (Snow, Tabors, & Dickinson, 2001). Without extended discourse, children have few opportunities to develop vocabulary, syntactic, and comprehension skills.

Variability in children's classroom language experiences

There is considerable variability in the language learning opportunities experienced by different children within one classroom. Several studies have found differences in the amount of time that individual preschool children spend engaged in language and literacy activities (Connor, Morrison, & Slominski, 2006; Pelatti, Piasta, Justice, & O'Connell, 2014). In Pelatti and colleagues' (2014) classroom observations, for example, children engaged in oral language activities with their teachers for an average of 3.5 minutes (SD = 3.7), but some children experienced vastly fewer opportunities for oral language than their classmates (i.e., differences of up to 24.4 minutes within the same classroom). Their data do not allow for investigation into why this variability occurred. Connor and colleagues (2006) found that the amount of time children spent on language and literacy activities was associated with their language growth. If individual children are having such variable experiences in the classroom, it is unlikely that classroom quality is one-size-fits-all. Some children may access more language learning opportunities than their classmates, thereby reaping greater benefits from their ECE experience.

In addition to differences in the amount of time spent on language-related activities, children have unique experiences due to the bidirectional relationship between teacher and child language. For example, Justice and colleagues (2013) found that individual children's syntactic complexity increased when their teachers spoke to them using more complex sentences, and teachers matched their syntactic complexity to children's as well. This suggests that there may be a Matthew effect at play, in which the linguistically "rich get richer" and the "poor get poorer" (Stanovich, 1986, p. 382). Children with lower oral language proficiency may receive less complex language input from their teachers, thus preventing their oral language from improving. Because of this bidirectional relationship, different children within the same classroom will hear

different language from their teachers and thus may have different opportunities for language development.

Recognition of children's unique classroom language experiences led to the development of an instrument that measures child-level language interactions in the preschool classroom: the Language Interaction Snapshot (LISn; Atkins-Burnett, Sprachman, & Caspe, 2010). Researchers' tendencies to generalize information about one child's experience to all children in a classroom, however, still persist. Although the LISn was specifically designed to capture details about individual children's language experiences in the classroom, most published studies using the measure have aggregated the results from individual children to describe classroom-level patterns. For example, based on two pilot studies by the LISn developers, Atkins-Burnett, Sprachman, Lopez, Caspe, and Fallin (2011) described patterns of language use across classrooms (e.g., teachers gave directions and requested language from children more often than they used other categories of talk). Bratsch-Hines et al. (2019) used hierarchical linear modeling to examine the relationship between teacher talk and children's language outcomes, but they calculated classroom-level averages of teacher talk, rather than focusing on individual children's language exposure. They found that more exposure to teacher talk was positively associated with children's expressive language skills at the end of the school year. Similarly, Franco et al. (2019) averaged child talk for the 3-5 focal children in each classroom; they found that children who talk more have higher expressive vocabulary growth over the course of the year.

To the best of my knowledge, only one prior study has instead used the LISn to highlight differences among children's experiences. Sawyer and colleagues (2018) described the experiences of 288 children in 72 classrooms, using analyses of variance to highlight differences in the classroom language experiences of Spanish-dominant DLLs, bilingual DLLs, and English

monolingual children. They found that all children spoke more to their peers than their teachers, and there were no differences in how much children talked based on language background. There were differences, unsurprisingly, in their usage of English versus Spanish. All children and teachers used more English than Spanish, but children with higher English proficiency spoke more to their peers in English than their less-proficient peers, and those with higher Spanish proficiency spoke more to their peers in Spanish. There were no differences among the groups in how much they spoke to teachers or how much English versus Spanish they used in teacher-child interactions. Overall, the authors conclude that there was little variation in children's classroom language experience based on their DLL status. Even though they sought to understand how an individual characteristic relates to children's classroom language experiences, this study's analyses were aggregated by language status across classrooms, and they did not consider how children's multiple characteristics may work in concert. The current study adds to this emerging body of research by focusing primarily on within-classroom differences in children's language experiences and beginning to investigate why these differences may occur.

Children's characteristics and their classroom language experiences

Some variability in children's classroom language use and exposure is likely related to individual child characteristics, such as language proficiency. Sawyer and colleagues (2018), for example, found that English monolingual preschoolers talked more to their peers in English than did bilingual or Spanish-dominant children. Teachers may also adapt their language based on their perceptions of children's language abilities. For example, Wasik and Hindman (2014) found that teachers were reluctant to use decontextualized language with their least English-proficient students. By making such adaptations, teachers may be individualizing instruction based on their perceptions of children's needs and competencies, or they may be exhibiting bias.

Certain aspects of children's temperament or behaviors, such as shyness, may also be related to their language use in the classroom. Shyness is characterized by an apprehensive reaction to unfamiliar people or situations, and shy children behave more cautiously than their less-shy peers (Rothbart, Ahadi, Hershey, & Fisher, 2001). Less-shy children display more sociability than their shyer peers, which is likely to result in more frequent interactions with their teachers and peers. Shy children are less likely to speak out of turn in the classroom than their more extroverted peers, and they may be more compliant with teachers' expectations (Keogh, 2003). It is likely that children's regulatory skills, including inhibitory control (i.e., the ability to inhibit an inappropriate but desirable response, such as taking another child's toy), also influence how often they speak in the classroom. In a longitudinal study of children in 1st and 3rd grade, Rudasill (2011) found that children with low shyness and low effortful control (i.e., a combination of inhibitory control and attention) initiated more interactions with their teachers and vice versa. It is possible that similar patterns of language behavior are found in preschool classrooms, but there are substantial differences in classroom structure (e.g., extended time for free play) that may alter the relationship between child temperament and classroom language use. Rudasill and her colleagues' prior work considers the relationship between preschool children's temperamental profiles and their teacher-child relationships, but these studies do not address classroom language (Justice, Cottone, Mashburn, & Rimm-Kaufman, 2008; Rudasill, Rimm-Kaufman, Justice, & Pence, 2006). They find that children's effortful control is negatively related to their level of conflict with teachers. To date, no known studies have examined how children's temperamental differences might be associated with their language experiences in the preschool classroom.

Children's patterns of classroom language use may vary by additional background characteristics, such as gender. Girls tend to develop language earlier than boys (Gleason & Ely, 2002) and score higher on early measures of vocabulary (Huttenlocher et al., 1991). A meta-analysis by Leaper and Smith (2004) showed that young girls (aged 1-3 years) are significantly more talkative than boys (d = 0.32), possibly due to early developmental differences between the genders. The authors also found that girls of all ages were more talkative than boys during adult-child interactions. In addition to differences in talkativeness, boys and girls may make different choices about what classroom activities to participate in. For example, in a large-scale multi-state study, Early and colleagues (2010) found that during free choice, boys spent less time than girls on language and literacy activities. A cluster analysis by Tonyan and Howes (2003) found similar differences in boys' and girls' time spent in the classroom.

Improving children's classroom language experiences

There is some indication that classroom language varies based on established measures of classroom instructional quality. One common measure, the Classroom Assessment Scoring System (CLASS; Pianta, La Paro, & Hamre, 2008), evaluates teachers' and children's interactions at a classroom level, and has been shown to predict children's academic gains (Howes et al., 2008; Mashburn et al., 2008). A pilot study by Atkins-Burnett and colleagues (2011) found that the frequency of teachers' talk in English was moderately correlated (r = .55) with the instructional support domain of the CLASS measure.

A clear way to improve the quality of classroom language practices is through professional development for ECE teachers. Through coursework, coaching, and video observations, teachers can learn new strategies for supporting children's language development and engaging in rich teacher-child interactions. Studies of language-specific professional

development programs have shown that preschool teachers can apply these strategies in the classroom, often resulting in improvements to children's language outcomes (Buysse, Castro, & Peisner-Feinberg, 2010; Cabell, Justice, McGinty, DeCoster, & Forston, 2015; Castro et al., 2017; Powell, Diamond, Burchinal, & Koehler, 2010; Wasik & Hindman, 2011; Weiland & Yoshikawa, 2013; Wilson, Dickinson, & Rowe, 2013). This research has shown that, while possible, changing teachers' language behaviors can be a difficult task, so professional development materials should be relevant to teachers' existing practices and presented in an accessible way (Grifenhagen, Barnes, Collins, & Dickinson, 2017).

Sometimes teachers' implementation of new strategies may depend on their perceptions of the children in their classroom. For example, in a vocabulary intervention study, Wasik and Hindman (2014) used professional development to encourage Head Start teachers to use more contextualized and decontextualized language in their classrooms. After training, they saw increases in teachers' use of contextualized language, which translated to vocabulary gains for children; however, teachers still used decontextualized language infrequently. The teachers perceived decontextualized language as challenging for children and may have been concerned about losing children's attention or only reaching the most linguistically advanced children in their classrooms (Wasik & Hindman, 2014). Therefore, in designing professional development materials, it is essential to understand how teachers' perceptions of the children in their classrooms may influence their uptake of new instructional strategies.

Bioecological model of development

This study approaches the investigation of children's classroom language experiences using the bioecological model of development (Bronfenbrenner & Morris, 2006). Stemming from Bronfenbrenner's (1986) ecological systems theory, the bioecological model considers how

children's biological and psychological characteristics interact with the various contexts surrounding them as they develop. While children's development takes place in a series of nested contexts, this study focuses on the *microsystem*, which includes settings that are experienced directly by the child—including the classroom—and the activities that take place in these settings. In examining the proximal processes of the classroom (i.e., interactions between children and their teachers and peers), I consider how the microsystem may vary as a function of children's characteristics, including their shyness, inhibitory control, language proficiency, gender, age, and disability.

Children are not passive recipients of their social environments; rather, they actively shape their contexts through their biology, psychology, and behaviors. This is similar to the process described by Bandura (1997) as *triadic reciprocal causation*, in which the biological and psychological characteristics of a person interact with the person's behaviors and environment to enable learning. The three factors are interdependent in that each influences and is influenced by the other two. This interdependence is particularly salient in the preschool classroom, which provides children with ample freedom to choose how they spend their time; many preschoolers spend most of their classroom day in "free choice" (Fuligni, Howes, Huang, Hong, & Lara-Cinisomo, 2012). This freedom may result in substantial differences in children's preschool classroom experiences. For example, a shy child may seek out a particular activity that requires minimal language, thus dictating the types of behaviors she can engage in during the activity and limiting the context for her language learning. Similarly, boys and girls tend to spend a significantly different amount of time in language-rich classroom activities, as mentioned previously (Early et al., 2010; Tonyan & Howes, 2003). In this dissertation, I examine the interdependent relationships among children's characteristics and the language environment of

their preschool classrooms, with a particular focus on how children's biology and psychology shape their behavior and environment (i.e., classroom language use and exposure).

The current study

This study examines within- and between-classroom variability in children's use of and exposure to language in the preschool classroom and investigates how children's characteristics––namely their shyness, inhibitory control, English and Spanish proficiency, gender, age, and disability—relate to within-classroom variability. Using classroom observations of individual children's experiences, I analyze the frequency of each child's language use and their exposure to teachers' use of specific categories of language. These categories include language types, such as contextualized and decontextualized language, and language functions, such as giving directions and requesting language from children. Descriptive analyses examine variability both within and across classrooms, and multilevel regression assesses the relationship between children's characteristics and their classroom language use and exposure. Figure 1 displays the variables I investigated. I use the child and classroom characteristics on the left side of the figure to predict various aspects of children's language use in the classroom and their exposure to teacher language, as shown on the right side of the figure. While I expect that many of these variables are bidirectionally related (e.g., a child's English proficiency will influence how often teachers use contextualized language with her, which will in turn influence her English proficiency), this study focuses on understanding how individual children's experiences differ based on their own characteristics and their classroom's instructional support quality. I also investigate whether classroom instructional support has a moderating effect on the relationship between children's characteristics and their classroom language experiences.

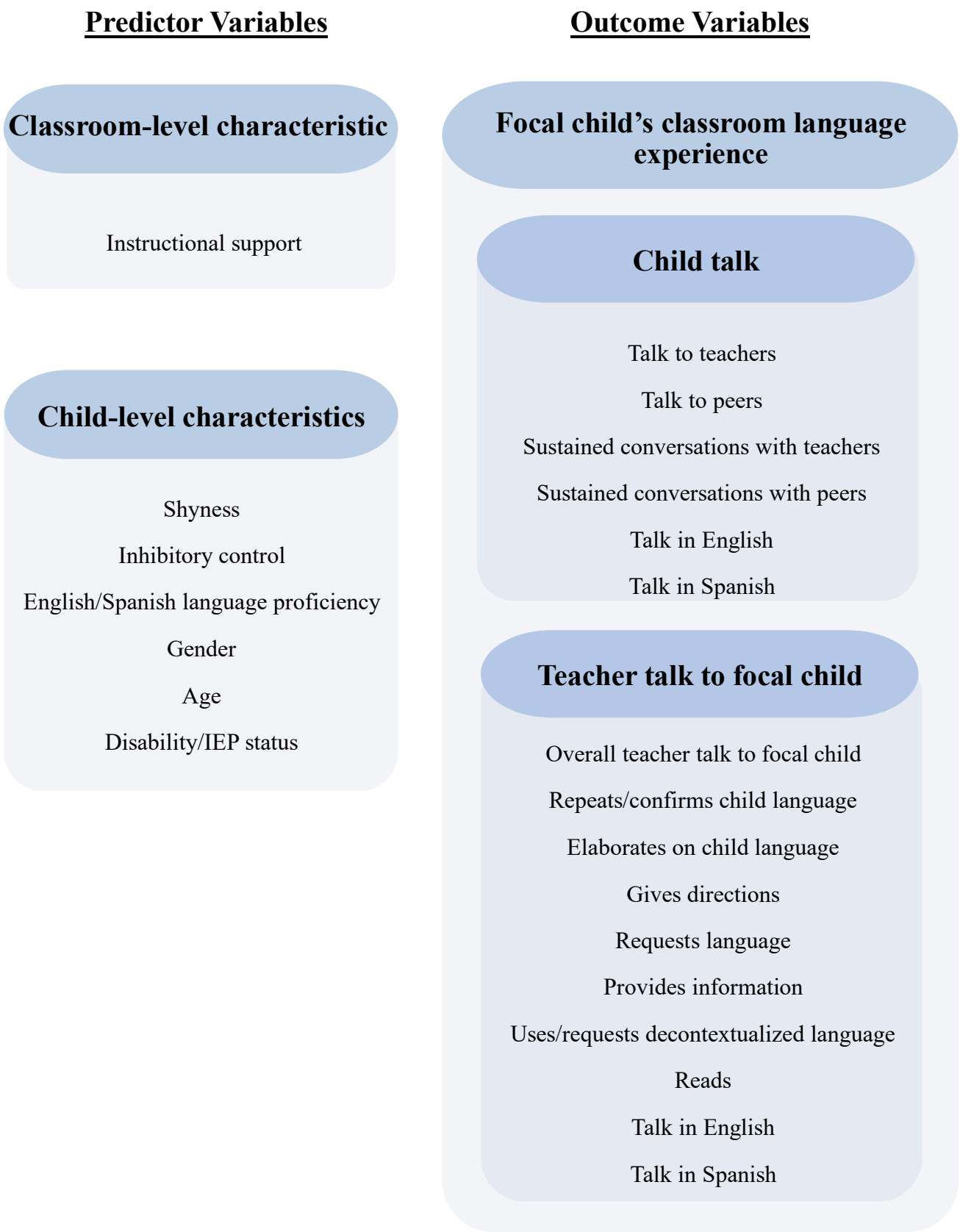

Figure 1. Predictor and outcome variables

In this dissertation, I answer the following questions:

RQ1: What variability can be seen in the amount of language that individual children speak in their Head Start preschool classrooms?

Sub-RQ1a: To what extent is this variability related to children's characteristics (e.g., shyness, English/Spanish language proficiency, gender) or classroom quality (i.e., CLASS Instructional Support ratings)?

RQ2: What variability can be seen in the amount of teacher language directed toward individual children in preschool classrooms and the repertoire of language types (e.g., requests, repetition, direction, decontextualized language) that teachers use?

Sub-RQ2a: To what extent is this variability related to children's characteristics (e.g., shyness, inhibitory control, English/Spanish language proficiency, gender) or classroom quality (i.e., CLASS Instructional Support ratings)?

Anticipated Results

In the descriptive analyses, I expect to see variability in the amount of language that children speak and the amount and type of teacher talk spoken to them, both within and across classrooms. I expect that the frequency of children's talk will be correlated with teacher talk, such that children who talk more to their teachers are spoken to more often, and vice versa. Existing research is limited in terms of associations between children's characteristics and their language use/exposure, so most analyses are exploratory, but I have several hypotheses.

I expect that children's language proficiency will be associated with their classroom language use and exposure. Specifically, I expect to find a positive relationship between children's English language proficiency and their use of English, and their Spanish proficiency and use of Spanish. I expect to find negative relationships between their ELP and use of Spanish and between their SLP and use of English. In the only known prior study that examined

differences in teacher language based on children's language backgrounds, there were no significant associations between children's DLL status (i.e., English monolingual, bilingual, or Spanish dominant) and teacher's use of the various LISn language categories (Sawyer et al., 2018). However, this study used analyses of variance (ANOVA), which did not account for the variance shared by children in the same classroom, and the researchers classified children into language status categories based on teacher report, rather than direct assessment. The current study's use of multilevel modeling and direct language assessment affords more precision to investigate associations between children's language proficiency and their teachers' use of language. For teacher language, I hypothesize that teachers will use decontextualized language more often with children with higher ELP (Wasik & Hindman, 2014).

I may also find differences based on children's other characteristics. In terms of shyness and inhibitory control, I expect that children who are more shy and have higher inhibitory control will speak less in the classroom (Rudasill, 2011; Rudasill et al., 2006). Girls will likely talk more than boys (Early et al., 2010; Leaper & Smith, 2004; Tonyan & Howes, 2003). Assuming child and teacher talk are correlated, I also hypothesize that, overall, teachers will talk more to girls and children with low shyness and low inhibitory control. As for the teacher talk categories, I expect that teachers will give directions more frequently to children with low inhibitory control.

I anticipate that some variability will be accounted for by classroom instructional quality, such that classrooms with higher CLASS Instructional Support will contain more instances of teacher decontextualized language, repeating of child language, and requests for child language, all of which Atkins-Burnett et al. (2011) found were correlated with CLASS ratings. I expect to find more child speech in classrooms with higher CLASS Instructional Support ratings, even though the previous study of relationships between LISn and CLASS did not find a statistically

significant relationship (Atkins-Burnett et al., 2011); my study includes twice as many snapshots for each child, thus providing more opportunities to hear child language. I may also find that classroom quality moderates the effect of children's characteristics on their classroom language use and exposure. For example, I hypothesize that the effect of children's characteristics will vary depending on classroom quality, such that higher-quality classrooms will demonstrate a weaker relationship between children's characteristics and the frequency of their talk. In other words, highly skilled teachers may be better equipped to support children's individual behavioral and learning needs, thereby ensuring that all children have more equitable learning opportunities in the classroom.

CHAPTER 2

Methods

This chapter presents the methods used to examine children's exposure to and usage of language in Head Start classrooms serving Spanish-English DLL and non-DLL preschoolers. Using classroom observations, I analyzed individual children's classroom language experiences and investigated between-classroom variability. With parent/teacher questionnaires and child assessments, I explored the relationship between children's characteristics and their exposure to and usage of language in the classroom. I also investigated whether a measure of overall classroom quality could predict children's language use or exposure, and I explored whether quality had a moderating effect on the relationship between children's characteristics and their classroom language experiences. I employed a primarily quantitative design, but this dissertation also illustrates some findings using transcribed excerpts from video-recorded observations.

Research Setting

This study was conducted in 21 Head Start preschool classrooms operated by a non-profit child care resource and referral agency in Los Angeles County. In 2017-2018, the local agency oversaw 24 Head Start centers with a total of 52 preschool classrooms. The children and families served by the agency are predominantly low-income, due to Head Start's eligibility requirements; approximately 87 percent of children served by this agency live in households with incomes below the federal poverty level, are receiving public assistance (e.g., TANF), are foster children, or are homeless. Approximately 80 percent of the children are dual language learners, with the majority of DLL children speaking Spanish in the home, followed by an additional group of children who speak Armenian or unspecified Middle Eastern, South Asian, and East Asian languages. Instruction in the agency's classrooms is conducted primarily in

English, but teachers are encouraged to provide support for students in their home languages when necessary. Each classroom had at least one teacher who was proficient in Spanish. The classrooms use The Creative Curriculum for Early Childhood, which is a widely used, comprehensive preschool curriculum that is child centered and based on constructivist theory (Dodge, Colker, & Heroman, 2002). In previous years, this agency's classrooms have been rated similarly to the national Head Start average on the CLASS, suggesting that their classroom quality is representative of Head Start as a whole. Out of a possible 7 points, the agency reported 2016-2017 average scores of 6.4 for Emotional Support, 6.1 for Classroom Organization, and 2.8 for Instructional Support across all its classrooms (compared to national averages of 6.1, 5.8, and 3.0, respectively; Office of Head Start, 2017). The average class size was 17 children, which is similar to national preschool averages; teacher-child ratios, however, were lower than national averages, at approximately 6:1 instead of 9:1 (Bowne, Magnuson, Schindler, Duncan, Yoshikawa, 2017).

Before the study began, administrators at the child care agency expressed a desire to focus on improving instructional practices for the dual language learners in their classrooms. When data collection started midway through the 2017-2018 academic year, the agency had offered its teachers 22 training workshops, none of which were related to language development or DLLs. In the year that followed, however, the agency has offered several two-hour professional development workshops on topics related to DLLs: Dual Language Model Strategies; Meaningful Activities for Dual Language Learners; Relationships with Families of Dual Language Learners; and Dual Language Learners in Preschool: How to Help Them Thrive.

The study was approved by the UCLA Institutional Review Board and involved a data sharing agreement between the child care agency and UCLA. To ensure confidentiality, teachers and children are assigned pseudonyms throughout this dissertation.

Sampling

I described the study to center directors at an agency-wide meeting, and each director decided whether her center would participate in the study. I then visited the nine participating centers in person to discuss the study with individual teachers and ask for their consent. Teachers were invited to participate in the study if their classroom enrolled mostly four-year-old children. Teachers in twenty-three out of twenty-eight classrooms agreed to participate. Two classrooms were dropped from the study during parent/child recruitment, because fewer than three children were consented to participate in the study.

Prior to the beginning of the study, the child care agency provided demographic and background information about enrolled children and their teachers. This included information about children's gender and home language, which were used to purposively sample six focal children from each classroom.

Children were excluded from the focal child pool if they had a home language other than English or Spanish, because the measures used in this study were designed for Spanish and English language use, and translations into other languages may not be valid or reliable without further instrument development and research. In addition, the linguistic and cultural diversity among children who speak different languages at home would have added more variance to the analyses, thus reducing power. There is considerable cultural diversity even among Latino, Spanish-speaking children (Baca Zinn & Wells, 2000), but the child care agency reported that the majority of Spanish-speaking children in their classrooms were of Mexican heritage, which may

minimize variance. Children were only considered for participation as focal children if their parents completed the Children's Behavior Questionnaire (CBQ), which is described in the Instruments section.

Six focal children (three girls and three boys, when possible) were randomly selected from the pool of eligible children in each classroom, for a total of 123 child participants aged 40 to 62 months (mean = 54 months).[3] When a sufficient number of children were consented in a classroom, I purposively selected children to achieve a balance of English and Spanish as the primary home language. I was unable to collect observational data for six children, so they were dropped from the study, resulting in a final sample of 117 children. In the final sample, 15 classrooms had 6 focal children, four classrooms had 5 children, one had 4, and one had 3. An a priori power analysis had indicated that a minimum of 127 child participants was needed to detect a relatively small effect size in the most complex planned models,[4] so some study analyses may be underpowered.

Participants

The participants in this study are 21 lead teachers, 40 assistant teachers,[5] and 117 children selected from within the 21 Head Start preschool classrooms included in this study.

[3] Three classrooms had fewer than six children who were given parental consent to participate in the study. These classrooms therefore had 5 focal children in the initial sample.

[4] This power analysis was conducted using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007). Parameters were set at: Effect size f2 = .12, Power = .0.8; alpha = .05. Power was calculated for the most complex model in the planned analyses (i.e., seven predictors). Existing studies that used the LISn have reported only descriptive findings, which makes effect size estimation difficult. Based on recent time-sampled studies of language in ECE classrooms, I expected the effect size to be small-to-medium (Connor, Vandell, & Sparapani, 2017,; Farran, Christopher, Nesbitt, & Meadow, 2017, April).

[5] Each classroom was supposed to be staffed with one lead and two assistant teachers at any given time. One classroom was understaffed during the observation and only had one lead and one assistant teacher. At another site, one assistant teacher was present during observations in two classrooms, due to another teacher's absence.

Teachers. All 61 teachers in the study were female, as seen in Table 1. The majority (79%) were Hispanic/Latinx, and the remaining teachers were non-Hispanic white (10%), Asian (2%), American Indian or Alaskan Native (2%), or other/unreported (13%). The majority of teachers were bilingual (79%), speaking English in addition to Spanish (68%), Armenian (5%), Farsi (3%), or Tagalog (2%). English was the primary language of 84% of teachers. Teachers had a range of educational backgrounds; most teachers had an Associate's degree (24%) or Bachelor's degree (39%). All lead teachers had either an Associate's or Bachelor's degree. Teachers had been employed by the agency for an average of 6 years and 7 months (SD = 5;5; *n* = 60). The mean teacher age was 48 years; 1 month (SD = 11;0; *n* = 39).

Table 1

Teacher Characteristics

Characteristics	Number	Percent
Gender		
Female	61	100
Race		
White (Non-Hispanic/Latinx)	6	10
White (Hispanic/Latinx)	46	74
Asian	1	2
American Indian or Alaska Native	1	2
Other	2	4
Unspecified	5	8
Primary language		
English	51	84
Other language	10	16
Other language spoken		
Spanish	42	69
Armenian	3	5
Farsi	2	3
Tagalog	1	2
None/Unreported	13	21
Education level		
High School Graduate/GED	2	3
Some college or advanced training	18	29

Associate's Degree	15	24
Bachelor's Degree	24	39
Unspecified	2	3
Position		
Assistant Teacher	40	66
Lead Teacher	21	34

Note. Percentages may not total 100 due to rounding. GED = General Education Diploma.

Children. On average, focal children were 4 years; 6 months at the beginning of data collection (SD = 4.7 months), as seen in Table 2. There were 61 boys and 56 girls (52% and 48%, respectively) in the sample. The majority of focal children (n = 110; 94.0%) were Hispanic/Latinx, and the remaining children were white, Black, Asian, and multi-racial. Children's primary home language was either English (36%) or Spanish (64%), but most children (86%) were in some way exposed to Spanish in the home. See Appendix A for an explanation of how children's home language was determined based on conflicting data sources (i.e., school administrative records, assessment records, and teacher report). Fifteen children (13%, the same as the national Head Start average; Office of Head Start, 2018) had a diagnosis for an Individualized Education Plan, indicating that they had been diagnosed with special needs. All 15 were identified as having a speech or language impairment; two children had additional non-categorical/developmental delays. Reflective of Head Start's eligibility requirements, 90% of children in the sample lived in households that were receiving public assistance (e.g., TANF, SSI) or had incomes under 130% of the federal poverty level. There was a range in the highest level of parent education in each household, from Grade 9 or Less (21%) to Associate's/ Bachelor's degree (9%).

Table 2

Child Characteristics

Characteristics	Number	Percent
Gender		
Male	61	52
Female	56	48
Race		
White (Non-Hispanic/Latinx)	3	3
White (Hispanic/Latinx)	107	91
Black/African American (Non-Hispanic/Latinx)	2	2
Black/African American (Hispanic/Latinx)	1	1
Asian	1	1
Bi-racial/Multi-racial	2	2
Unspecified	1	1
Primary language		
English	42	36
Spanish	75	64
Individualized Education Program (IEP)		
No	102	87
Yes (Speech or Language Impairment)	15	13
Head Start Eligibility		
Income below 100% FPL	70	60
Income 100 < 130% FPL	20	17
Over Income	12	10
Public Assistance	13	11
Foster Care	1	1
Unspecified	1	1
Highest Level of Parent Education		
Grade 9 or less	25	21
Grade 10	2	2
Grade 11	6	5
Grade 12	3	3
High School Graduate/GED	36	31
Some College or Advanced Training	31	26
College Degree/Training Cert.	3	3
Associate's Degree	3	3
Bachelor's Degree	8	7

Note. Percentages may not total 100 due to rounding. FPL = federal poverty level. GED = General Education Diploma.

Procedures

Questionnaires. In winter of 2018, the Children's Behavior Questionnaire (CBQ; Rothbart, Ahadi, Hershey, & Fisher, 2001) was sent home with consented children for parents to fill out and return. Teachers' CBQs were completed in the spring, when teachers had observed children's behaviors for at least six months. See Table 3 for the timeline of data collection.

Table 3

Recruitment and Data Collection Schedule

Date	Activities
June – July 2017	Recruited child care agency to participate in study
August – October 2017	Received UCLA IRB approval Finalized Memorandum of Understanding between UCLA and child care agency
October – November 2017	Teacher recruitment/consent Received initial round of child care agency records
November 2017 – January 2018	Child recruitment/parent consent Focal child selection
January 2018	LISn training *pre*LAS pilot testing/practice assessments
January – March 2018	Parent CBQs
February – April 2018	*pre*LAS assessments Practice/reliability LISn classroom observations
March – May 2018	Teacher CBQs
May 2018	LISn classroom observations
August 2018 – May 2019	Received additional child care agency records

Direct child assessments. Once a classroom's focal children were selected, I conducted individual assessments of their English and Spanish oral language proficiency. Data collectors were CITI (Collaborative Institutional Training Initiative) certified undergraduate research assistants who were proficient in the language of the assessment (i.e., English or Spanish). All assessments were conducted during instructional breaks in a quiet, private space in or near the

child's classroom, and each testing session lasted approximately 10–20 minutes. Data collectors conducted separate testing sessions at least one week apart in each of the languages, in order to avoid practice effects and follow the procedures used by Lopez and Greenfield (2004). The language in which the children are first tested was counterbalanced. Children were given a sticker at the conclusion of each data collection session.

Classroom observations. Six data collectors, including the author, attended a one-day training on using the Language Interaction Snapshot (LISn) observational measure (Atkins-Burnett et al., 2010). Data collectors then completed at least one practice observation visit and one reliability visit. Each classroom's study observation was completed by two data collectors and took place in the morning, when all classrooms followed a similar schedule of activities, including whole-group/circle time, center/free-choice time, outdoor play, and sometimes breakfast/lunch. Each data collector observed three different focal children during the three-hour observation period, pausing the observation only for children's bathroom breaks. Through this process, two children were observed at a time, for a total of six children per classroom.[6] As they followed focal children around the classroom, observers maintained a comfortable distance but had to be in close enough proximity in order to hear their interactions. The children appeared comfortable with the observers' presence in their classrooms; from the consent process, language assessments, and practice observations, we had spent three to six days in each classroom prior to the observation day.

To gather examples of teacher-child and peer interactions, we video-recorded the observation in 13 classrooms (i.e., all the classrooms in which teachers and parents provided consent for video-recording). During the LISn observation period, a camera was placed on a

[6] In several classrooms, observations were conducted on two days, due to child absences and data collector schedules.

tabletop tripod and moved as necessary throughout the observation, following one or more focal children around the classroom. At any given time in each video recording, one to six focal children are on screen. The videos were selectively transcribed in order to gather quotes that illustrate the categories of teacher and child language captured by the LISn. We made a particular effort to transcribe all sustained conversations (i.e., more than two conversational turns) that were captured on video, because these illustrate children's most rich interactions. Audio quality was sometimes insufficient for transcription.

Instruments

Children's classroom language experiences. Children's individual classroom language experiences were measured using a standardized observational protocol, the Language Interaction Snapshot (LISn), described below. All outcome variables were derived from the data collected with this instrument.

Language Interaction Snapshot (LISn). The LISn (Atkins-Burnett et al., 2010) is an observational tool intended for use in preschool classrooms with dual language learners. Observers examined the experience of one focal child at a time, using a time-sampling procedure to record details about teacher and child verbal communication during separate 5-minute coding periods (i.e., snapshots). The observer began by locating Focal Child 1 and following that child around for five minutes before commencing observations for Focal Children 2 and 3. This process was repeated until each child had been observed for six snapshots, each of which was comprised of ten 30-second observation cycles.[7] Each child was observed for a total of 60 cycles (30 minutes), spread out across a two- to three-hour period. See Figure 2.

[7] Two children were observed for five snapshots (50 cycles) due to data collector error.

In each 30-second observation cycle, observers coded instances of focal child speech and any teacher speech that was directed toward the focal child (either alone or in a group). See Appendix B for the LISn protocol. If the child spoke during a given cycle, the observer would indicate what language they used (i.e., English, Spanish, or a mixture of both) and whom they spoke to (i.e., lead teacher, other adult, other children). When a teacher spoke to the child, the observer indicated which language they spoke and identified the category of language type or function: repeats/confirms the focal child's utterance; elaborates/builds on the focal child's utterance; gives directions; requests language (contextualized); provides information/names/ labels (contextualized); provides/elicits information (decontextualized); reads; sings; or engages in other talk. Data collectors used the LISn manual's definition of decontextualized language, which called for coding instances when the teacher provided or asked for information that was communicated solely using language, without contextual cues (e.g., visual or physical cues in the environment, facial expressions, or physical movements). This most often occurred in discussions of the past or future. The LISn measured binary occurrences per cycle, rather than frequencies, so we could not capture if a category occurred more than once in a 30-second cycle (e.g., the child spoke in English twice to the lead teacher).

Immediately following each snapshot, the observer finalized notes on that snapshot and filled out a form with information about the classroom context, including all content areas (e.g., mathematics, fine motor) and activity structures (e.g., whole group, routine) that the focal child was engaged in during the five-minute snapshot. By observing all three focal children within approximately 15-minute intervals, we aimed to capture each focal child during the same set of activity structures (e.g., if circle time lasted 20 minutes, all focal children would be observed in that setting). We also tallied the number of times the focal child participated in sustained

conversations with the lead teacher, other adults, or other children. A conversation was considered sustained if there were more than two conversational turns (e.g., Child-Teacher-Child-Teacher-Child).

Each rater completed at least one reliability visit, in which the rater observed a child along with the author. Reliability for each observer was calculated based on five snapshots, using a spreadsheet provided by the LISn developers. For each snapshot, the reliability spreadsheet calculated the frequency that the two observers assigned each category of talk (e.g., Child Talks to Lead Teacher). It then calculated the number of disagreements for each category and averaged this across snapshots, resulting in a percent agreement for each category. Overall reliability was calculated as the average of all 21 categories. Reliability across all raters was 96.4% on English categories and 99.7% on Spanish, above the 90% threshold set by the LISn developers. Every individual rater had at least 93% agreement on the English categories and 99% on Spanish. Reliability on the classroom context form was 90.2% exact agreement, and 99.1% within-one agreement, well above the 85% within-one threshold. Individual raters had at least 87% exact agreement about classroom context and had at least 98% within-one agreement.

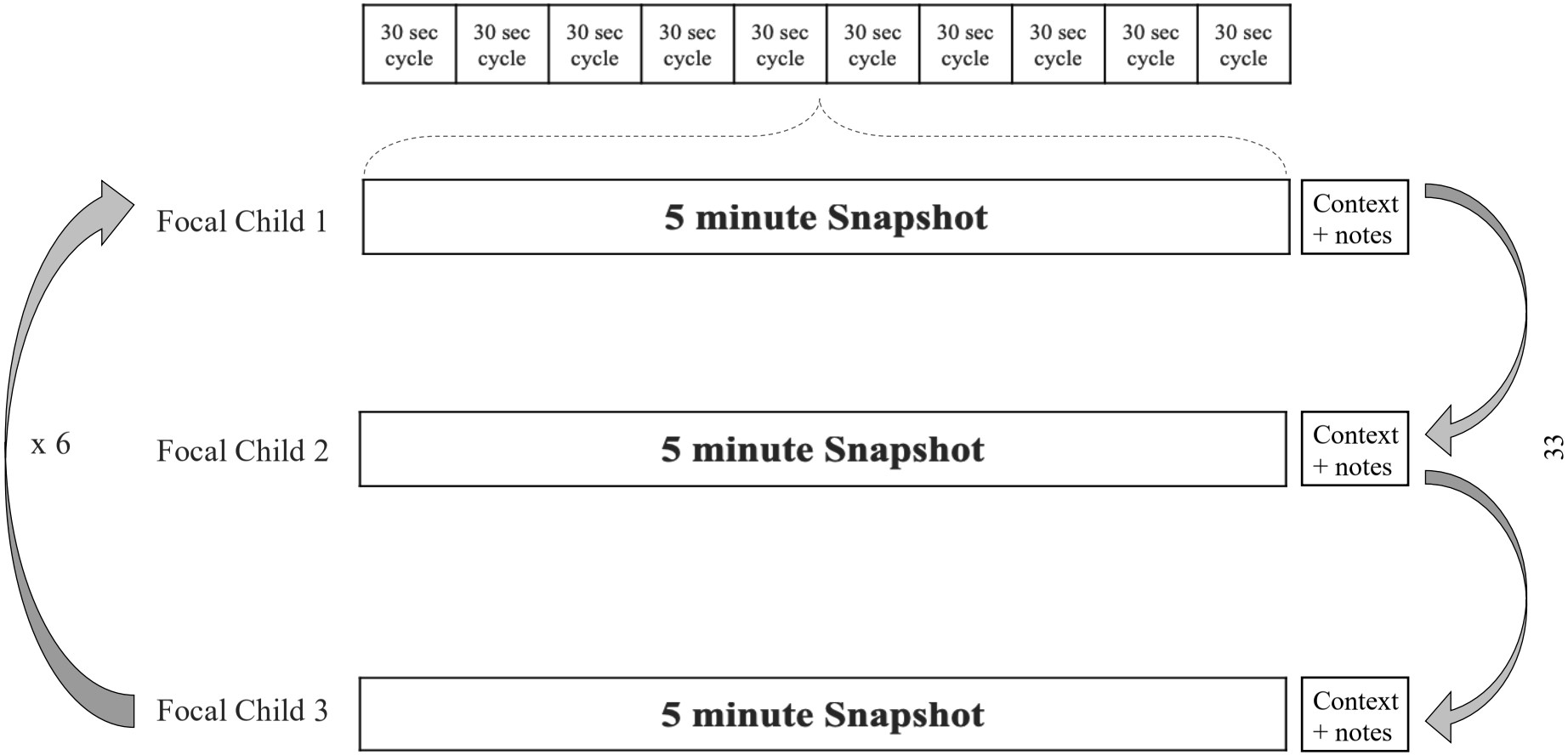

Figure 2. LISn procedure, starting at the top of the diagram with the first snapshot for Focal Child 1

Child characteristics. School records, teacher and parent questionnaires, and direct child assessments provided background information about children that was used to predict variability in children's classroom language experiences. See Table 4 for a list of instruments and their uses.

Table 4

Instruments and Their Uses

Instrument	Data Type	Use and corresponding RQs
School records	Child and teacher demographics and background characteristics	Focal child selection + RQ1 + RQ2 + Sub-RQ1a + Sub-RQ2a
LISn	Child classroom language experiences	RQ1 + RQ2 + Sub-RQ1a + Sub-RQ2a
CBQ	Parent/Teacher ratings of child shyness and inhibitory control	Sub-RQ1a + Sub-RQ2a
*pre*LAS: 2000	Child language proficiency (English/Spanish)	Sub-RQ1a + Sub-RQ2a
CLASS	Classroom quality	Sub-RQ1a + Sub-RQ2a

School records. The child care agency provided demographic and background information about enrolled children. This included child demographics and background information (i.e., child's birth date, gender, race/ethnicity, languages the child hears and speaks at home, whether the child has an Individualized Education Program (IEP) for special education services, diagnoses for any disabilities, and the length of time the child has attended English-language child care). After completion of the study, the agency provided additional demographic data (i.e., parent education, household income, Head Start eligibility criteria) as well as recent child assessment results (i.e., Desired Results Developmental Profile [DRDP], Ages and Stages Questionnaire [ASQ]).

Children's Behavior Questionnaire (CBQ) – Shyness and Inhibitory Control scales. Parents and teachers completed several scales from the Children's Behavior Questionnaire, which is a widely used parent-report assessment of temperament for children aged 3 to 8 years (Rothbart, Ahadi, Hershey, & Fisher, 2001). Prior studies have used a slightly modified CBQ

with teachers in order to accurately capture children's behaviors that may be unique to the classroom (e.g., Rudasill et al., 2014). Respondents rate statements about the child (e.g., "This child is sometimes shy even around people s/he has known a long time") using a 7-point Likert-type scale (1 = *extremely untrue* to 7 = *extremely true*) with an eighth option for "Not applicable."

The full CBQ includes fifteen scales, but this study used two scales, which are each comprised of 13 items that are averaged to get a score. Shyness is described as a "slow or inhibited approach in situations involving novelty or uncertainty," and includes items such as "Acts very friendly and outgoing with new children." Inhibitory Control is "the capacity to plan and to suppress inappropriate approach responses under instructions or in novel or uncertain situations." It includes items such as "Can wait before entering into new activities if s/he is asked to." The CBQ scales have moderate to high internal consistency among 4- and 5-year olds: Shyness ($\alpha = .92$) and Inhibitory Control ($\alpha = .76$; Rothbart et al., 2001). The CBQ was provided to parents and teachers in paper format and was estimated to take approximately 15 minutes to complete for each child.

A Spanish language translation of the CBQ was provided to parents who preferred to complete the questionnaire in Spanish ($n = 67$; Carranza, González-Salinas, & Ato, 2013). This translation was done in Spain, so the current study team made several adaptations to account for dialectal differences between Spanish from Spain and Spanish from Mexico. There are no cultural adaptations of the CBQ available. Since data collection for this study, a group of Mexican scholars adapted the Spanish translation for Mexican Spanish (Falcón Albarrán, Miramontes, & Domm, 2018).

To strengthen the validity of my measures of shyness and inhibitory control, I combined parent and teacher ratings into one scale to provide a richer, more complete portrait of children.[8] Using multiple raters helps account for the unique perspectives that parents and teachers provide, given that they observe children in different settings. Parent and teacher ratings of shyness and inhibitory control were modestly, but significantly, correlated (r = .22 and r = .20, respectively). This modest relationship between parent and teacher ratings of children's behavior is typical, and previous researchers have combined similarly correlated (r < .3) parent and teacher ratings, including the CBQ (Eisenberg, Taylor, Widaman, & Spinrad, 2015; Gershoff, Aber, Raver, & Lennon, 2007). To create the composite score, I calculated the average of each child's parent and teacher ratings. Shyness ratings ranged from 1.50 – 6.42 (M = 3.66, SD = 0.87), as seen in Figure 3. Inhibitory control ranged from 3.31 – 6.88 (M = 5.07, SD = 0.73), as seen in Figure 4.

[8] I investigated the impact of this decision by also fitting all models using separate parent and teacher ratings. There were no changes to any of the findings described in this dissertation.

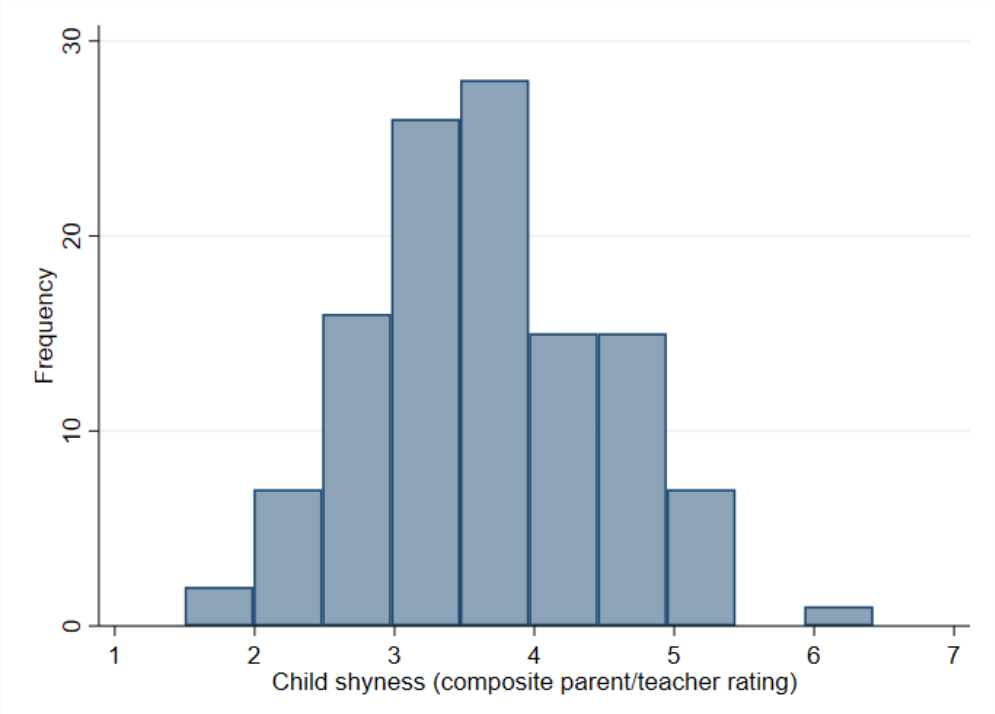

Figure 3. Histogram of shyness ratings

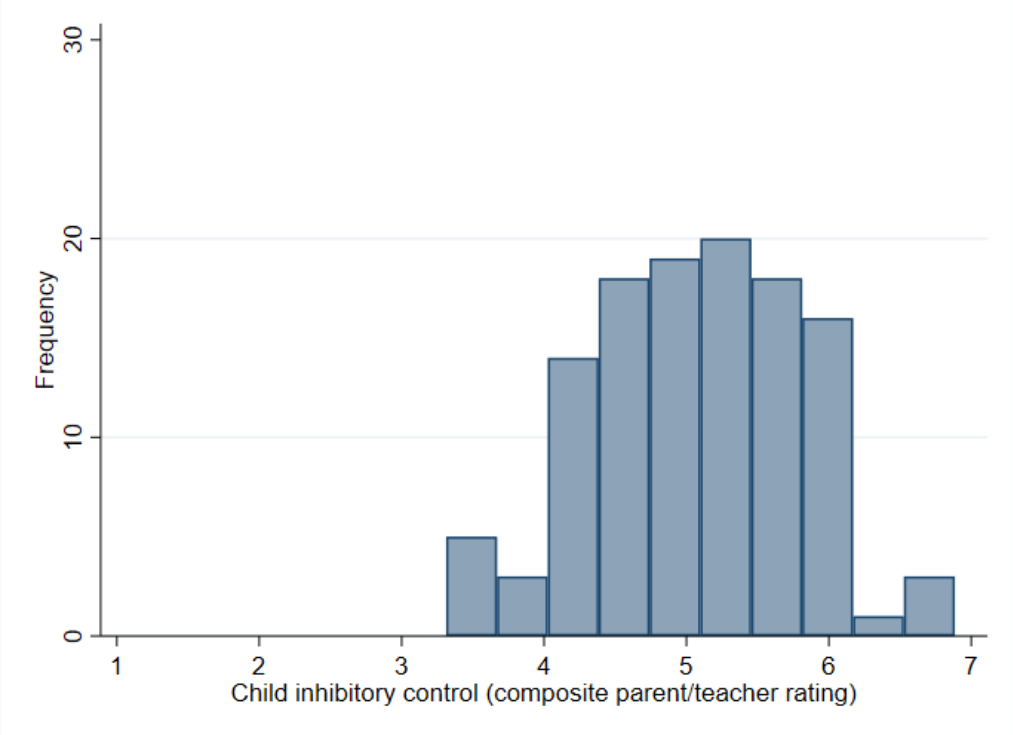

Figure 4. Histogram of inhibitory control ratings

pre*LAS 2000: Oral Language Component*. Each focal child's language proficiency was assessed using the *pre*LAS (Duncan & De Avila, 1998), a norm-referenced assessment of language proficiency for 4-6 year olds, comprised of Oral Language and Pre-Literacy components. The *pre*LAS was selected for use in this study because it is widely used, available in both Spanish and English, and designed to be used for screening, instructional decision-making, and progress monitoring of DLLs. The current study administered only the Oral Language Component, which is divided into five subtests that measure various aspects of oral language development using developmentally-appropriate games and activities. The subtests measured both receptive and expressive language, thus providing an advantage over measures that focus on one dimension of oral language ability (e.g., PPVT-III). In addition, the *pre*LAS subtests assessed children's language skills at multiple levels (i.e., vocabulary, morphology, syntax, and discourse), and they included the assessment of spontaneous-like speech samples, which approximate the types of language that children might use in the classroom.

The first subtest, Simon Says (Simon dice), assessed children's receptive understanding by asking them to follow action-oriented directions, such as "Simon says, touch your ear." The next subtest, Art Show (Muestra de arte), tested children's expressive vocabulary by asking them to look at images of common household and classroom items and label them or occasionally identify an object's function (e.g., "What can you do with a [book]?"). In Say What You Hear (Repeticion), children repeated phrases or sentences from an audio recording, which provides information about their ability to comprehend and produce morphological and syntactical features. The Human Body (El cuerpo humano) is similar to Art Show, in that children were asked to verbally label different parts of the body based on images. Each of these four subtests was comprised of ten items. If a child obtained five incorrect answers for a subtest, the examiner

moved on to the next subtest. In the final subtest, Let's Tell Stories (Contando cuentos), children first listened to a story and looked at accompanying pictures, and then they were asked to tell what happened in the story. Children's responses were later scored by a trained examiner using a rubric that assessed accuracy as well as vocabulary and syntactic complexity.

Scores for each subtest were calculated by summing the child's correct responses and multiplying by a weight specific to that subtest. Then the overall score was calculated by summing the weighted subtest scores. These overall scores can be analyzed directly or converted into five proficiency levels or three categories (i.e., 1 = *Non speaker*, 2 = *Limited speaker*, 3 = *Limited speaker*, 4 = *Fluent/Proficient speaker*, 5 = *Fluent/Proficient speaker*). Analyses in the current study use the overall scores. For English, these ranged from 0 – 97 out of a possible 100 points ($M = 58.32$, $SD = 19.39$). For Spanish, they ranged from 0 – 81 ($M = 43.29$, $SD = 20.19$). See Figures 5 and 6 for the distribution of scores.

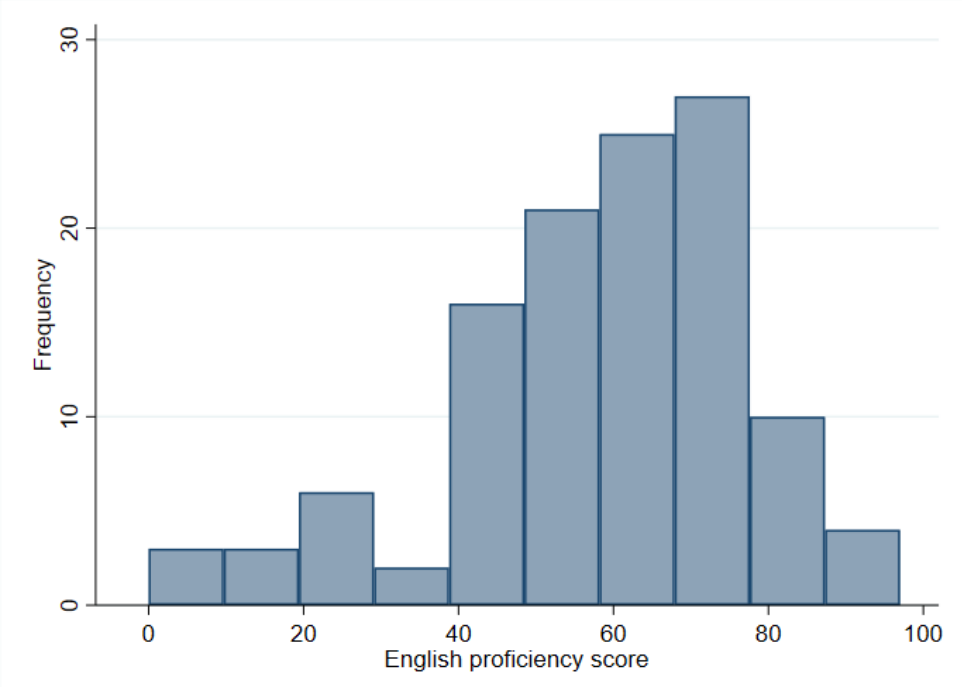

Figure 5. Histogram of English proficiency scores

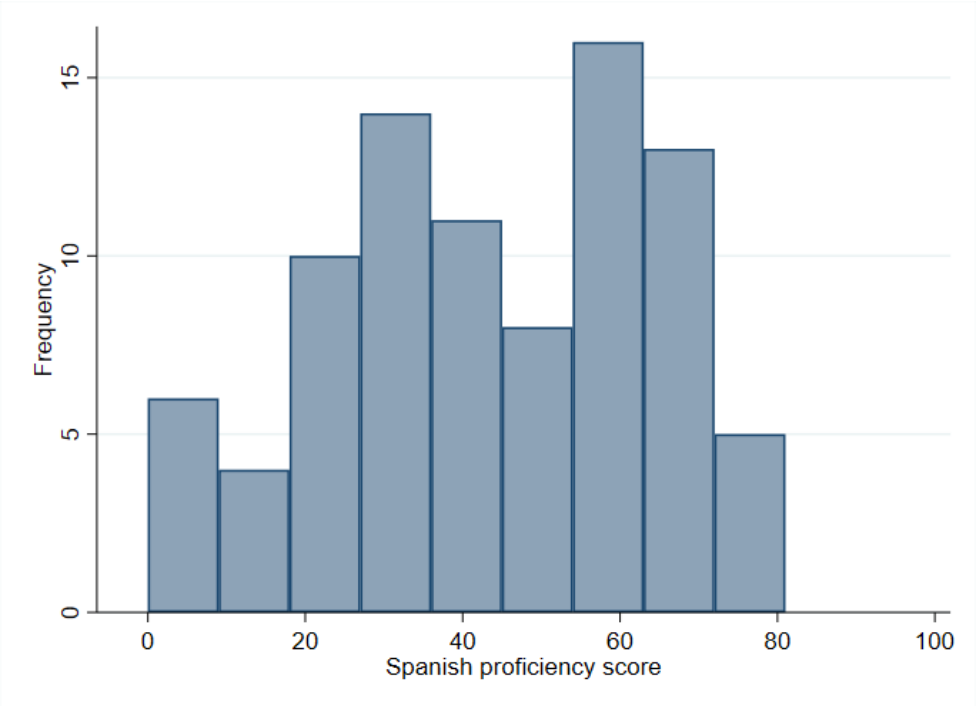

Figure 6. Histogram of Spanish proficiency scores

According to the assessment developer, internal consistency for the *pre*LAS ranges from medium to high across the subtests, with slightly lower values for some Spanish subtests. Cronbach's alpha ranges from .86 for The Human Body (.66 for El cuerpo humano) to .88 for Simon Says (Simon dice) and .90 for Art Show (.88 for Muestra de arte) and Say What You Hear (Repeticion). Cronbach's alpha is not available for the final subtest, Let's Tell Stories (Contando cuentos).

Teacher and classroom characteristics. Information about teachers provided context about the teacher participants, and a measure of classroom quality was used as a predictor and moderator in some analyses.

School records. The data provided by the child care agency included information about its teaching staff, including teachers' qualifications (i.e., degrees awarded, years of employment, languages spoken), teachers' demographic information (i.e., gender, age, race/ethnicity), and agency-level professional development history. The agency also provided recent scores from a

widely used measure of classroom quality, the Classroom Assessment Scoring System (CLASS), described below.

***Classroom Assessment Scoring System (CLASS) – Pre-K version*.** The CLASS Pre-K (Pianta, La Paro, & Hamre, 2008) is an observational tool that assesses classroom quality based on interactions among teachers and children. The CLASS was designed to evaluate classroom interactions in diverse classrooms, and studies have shown no significant differences in reliability across classrooms with varying numbers of dual language learners (Downer et al., 2012). In the CLASS, ten dimensions of classroom quality are identified across three broad domains of interaction—Emotional Support, Instructional Support, and Classroom Organization. Analyses in this study primarily used ratings for Instructional Support, because this domain measured language-relevant practices in three dimensions: Quality of Feedback (i.e., how effectively teachers responded to children's comments or actions in a way that expanded learning and encouraged participation); Language Modeling (i.e., whether teachers engaged in practices that supported children's language development, such as asking open-ended questions, repeating and extending children's language, engaging in conversations, and introducing advanced language); and Concept Development (i.e., teachers' use of activities and discussions that facilitated higher-order thinking and elaboration of concepts).

On one to three days during the academic year, the agency sent two trained CLASS raters into each classroom. In order to be certified, raters took a two-day training and then passed an inter-rater reliability test at 80% agreement with the "gold standard" master raters. During a session, raters simultaneously observed the classroom for two twenty-minute cycles and scored all ten CLASS dimensions on a 7-point Likert-type scale after each cycle. After the observation, the two raters reached consensus for their scores. An average score for each dimension was

calculated across the two cycles of each observation day. Analyses for the current study used the average score across all observations (i.e., two to six cycles total). The three dimension scores were summed to create an Instructional Support score ranging from 1 to 7, with 7 being the highest quality. The mean classroom quality was 3.36 (*SD* = .89), which is considered medium quality, and scores for the 21 classrooms ranged from 2.0 to 5.2.

CLASS ratings for the four classrooms at one site were lost by the agency due to a data storage issue. I retrieved CLASS ratings for the following academic year (2018-2019), but these are only a proxy for the classroom interactions that would have taken place in a CLASS observation during the study year. The lead teachers in each classroom were the same across both years, but the assistant teachers changed rooms between years. In addition, classroom dynamics and interaction patterns were likely different because there were different children in the classroom.

Analytic Procedures

In this section, I describe the analyses, all of which explore how much children and teachers talked in the classroom and what types of language teachers used with children. Outcome variables for these analyses are based on the LISn observation, during which observers coded binary (*yes/no*) instances of each language category (e.g., focal child talked to peer in English, lead teacher gave directions in Spanish) in a series of 30-second cycles.

RQ1: What variability can be seen in the amount of language that individual children speak in their Head Start preschool classrooms? I conducted descriptive analyses to illustrate the central tendency and dispersion of individual children's speech. Instead of using raw frequencies, I evaluated the percentage of cycles that contained instances of each LISn category, because two children had 50 cycles instead of 60. I examined the percentage of 30-

second cycles containing focal child speech, how much of that speech occurred with peers versus adults, how much occurred in English versus Spanish, and the number of times the child participated in sustained conversations. I collapsed Spanish and mixed Spanish/English into one category because both occurred infrequently. I also looked at correlations among all variables of child talk. Together, these findings are used to describe children's average language use across all classrooms.

Finally, I present intraclass correlations (ICCs) and box plots of each child-talk outcome variable to begin illustrating variability across classrooms and to determine whether multilevel modeling is appropriate for subsequent analyses. ICCs were calculated using linear mixed models:

$$\rho = \tau_{00}/(\sigma^2 + \tau_{00}),$$

where τ_{00} is the level-2 variance and σ^2 is the level-1 (residual) variance. The ICC estimates the proportion of variance in the child-talk outcome variable that can be explained by differences between classrooms, sometimes called the cluster effect. If the ICC is non-zero, this suggests that observations are not independent, and a multilevel modeling approach is appropriate for the data (Raudenbush & Bryk, 2002). For this study, however, the amount of variance described by ICCs is not a precise estimate. Linear mixed models assume the outcome variables are normally distributed, and most of the child-talk variables are positively skewed. An ICC cannot be calculated based on a non-normal distribution, because level-1 residual variance is a function of the distribution (e.g., equal to the mean in a Poisson distribution), rather than estimated from the data. Despite this shortcoming, linear mixed-model ICCs provide the best approximation of between-classroom variance. The models estimated in the following section account for the non-normal distributions of the outcome variables but do not estimate between-classroom variance.

Sub-RQ1a: To what extent is this variability related to children's characteristics (i.e., shyness, inhibitory control, English/Spanish language proficiency, gender) or classroom quality (i.e., CLASS Instructional Support ratings)? Based on the between-classroom variance found with the ICCs, I fit a series of multilevel models to examine the relationship between children's characteristics and how often they spoke in the classroom. These models account for variance in children's classroom language use that can be attributed to differences across classrooms (Level-1, n = 117; Level-2, n = 21). For example, children in some classrooms may have had more opportunities to talk throughout the day due to their classroom schedules, teachers' instructional practices, and other classroom-level factors. By accounting for between-classroom variation, multilevel models prevent the inflation of Type-I error that can occur when observations are not independent, such as when children are clustered within classrooms. They therefore provide more precise estimates of level-1 effects, such as shyness and English language proficiency, and help us understand within-classroom differences.

I systematically built a series of models that explored the relationship between child and classroom characteristics and the amount of child talk in the classroom. First, I tested the main effects of children's shyness, inhibitory control, and English language proficiency to see whether the predictors of interest were related to the LISn child-talk outcomes. Then I added child-level covariates that have previously been linked to children's language use (i.e., gender, whether the child had an IEP, and age) to see whether these predicted the amount of child talk or changed any relationships between the key predictors and outcome variables. Finally, I added classroom quality to see whether this classroom characteristic would predict the amount of child talk above and beyond any child-level characteristics.

It is worth noting that my data do not allow for claims of causality, and I cannot be sure of the directionality of the relationships I am testing. Without longitudinal data or experimental methods, it is impossible to interpret my findings as causal. While I use standard regression terminology (e.g., predictors, level-1 effects, outcome variables) to describe my analyses, it is possible that the equations I use could be flipped. For example, instead of estimating the effect of children's English language proficiency on their amount of talk in the classroom, I could test the effect of children's amount of classroom talk on their English proficiency. I believe that the relationships among many of my variables are bidirectional, such that a causal effect would be seen in both directions, if the data were to allow for such analyses.

Analyses in this section were based on six outcome variables: the number of cycles in which the focal child spoke to teachers, the number of sustained conversations the child had with teachers, the number of cycles in which the focal child spoke to peers, the number of sustained conversations the child had with peers, and the number of cycles in which the focal child spoke in English and Spanish. I examined the distributions of the outcome variables to determine the appropriate model type. All outcome variables are event counts, which have non-negative, often positively skewed distributions that do not meet the assumptions of linear regression. I therefore used negative binomial regression analyses, which are an extension of Poisson regression and a type of generalized linear modeling. Poisson regression assumes, however, that the mean of the outcome is equal to its variance. For most of the outcome variables in this study, the variance is larger than the mean, so negative binomial regression accounts for this over-dispersion by including an extra variance parameter in the model. Negative binomial regression cannot model outcomes that are percentages, so I used raw frequencies.

When modeling the number of cycles, I included an exposure variable (i.e., how many opportunities the child had to speak to teachers/peers) to accommodate differences in the number of cycles observed for each child (Raudenbush & Bryk, 2002). This exposure variable, m_{ij}, is used to determine the expected value and variance of the outcome variable, Y_{ij} , given the event rate, λ_{ij} :

$$E(Y_{ij} \mid \lambda_{ij}) = m_{ij}\,\lambda_{ij}\,, \qquad Var(Y_{ij} \mid \lambda_{ij}) = m_{ij}\,\lambda_{ij}$$

Using children's frequency of talk to peers as an example outcome variable, Y_{ij} is the expected number of cycles in which focal child *i* in classroom *j* spoke to his/her peers, and is calculated as the event rate, λ_{ij}, times the child's exposure, m_{ij} cycles. In Poisson and negative binomial regression, the predicted value of the outcome variable is transformed using a log link function:

$$\eta_{ij} = \log(\lambda_{ij})\,,$$

in which η_{ij} is the log of the event rate. Throughout the next two chapters, I express negative binomial regression findings as incidence-rate ratios (IRRs), which are exponentiated coefficients that compare the rate at which the outcome occurs across values of each predictor. IRRs are easier to interpret than their underlying coefficients, which represent the difference in the log of expected event rates. When an IRR is greater than 1, the expected rate increases as the predictor increases. When it is less than 1, the expected rate decreases as the predictor increases.

To test for the effect of children's shyness, inhibitory control, and English proficiency on their language use in the classroom, I built three models for each outcome variable. In Model 1, I tested the main effects of children's shyness (i.e., composite of teacher and parent CBQ ratings), inhibitory control (i.e., composite CBQ ratings), and English language proficiency (i.e., *pre*LAS overall score). Spanish proficiency was included as a predictor in the models of children's English and Spanish language use. In Model 2, I added child-level covariates that have

previously been linked to children's language use: gender ("1" if the child was female), whether the child had an IEP ("1" = Yes), and age in months (on the observation date). When modeling children's talk to teachers, I also included the frequency of teachers' requests for child language as a covariate. In Model 3, I added classroom quality (i.e., CLASS Instructional Support ratings) as a level-2 predictor. In all three models for each outcome variable, I group-mean centered the level-1 predictors by subtracting the classroom mean from each child's value. For example, children with shyness ratings equal to the average shyness in their classroom were assigned a zero, children rated higher (i.e., more shy) had positive values, and children rated lower (i.e., less shy) had negative values. I treated all level-1 coefficients as fixed, meaning that the slopes were not able to vary across classrooms.[9]

The following equations represent Model 1 for each outcome variable.

Level-1 (Within Classroom) Model:

$$\eta_{ij} = \beta_{0j} + \beta_{1j}(\text{Shyness}_{ij} - \overline{\text{Shyness}_{.j}}) + \beta_{2j}\left(\text{InhibCont}_{ij} - \overline{\text{InhibCont}_{.j}}\right) + \beta_{3j}(\text{ELP}_{ij} - \overline{\text{ELP}_{.j}})$$

Level-2 (Between Classroom) Model:

$\beta_{0j} = \gamma_{00} + u_{0j}$

$\beta_{1j} = \gamma_{10}$

$\beta_{2j} = \gamma_{20}$

$\beta_{3j} = \gamma_{30}$

Using the number of cycles the child talked to peers as an example outcome variable, η_{ij} in the level-1 equation is the log of the rate at which child *i* in classroom *j* talked to peers. β_{0j} is the log of the average number of cycles that children in classroom *j* with shyness and inhibitory control ratings and ELP scores equal to their classroom mean talked to peers. β_{1j}—the regression

[9] Future studies should treat these slopes as random, but unfortunately the within-class sample size in this study is likely too small to detect classroom-level differences in slopes; the models will not converge in either HLM or Stata when slopes are treated as random.

coefficient associated with shyness for classroom *j*—is the log of the change in the outcome associated with a one-point deviation of child *i*'s shyness from classroom *j*'s average shyness, holding constant inhibitory control and ELP. β_{2j} is the regression coefficient associated with inhibitory control for classroom *j*. β_{3j} is the regression coefficient of ELP for classroom *j*. In the level-2 model, γ_{00} represents the overall mean intercept, or the mean frequency of talk to peers, and u_{0j} represents the random effect for classroom *j*, or the deviation of classroom *j* from the overall mean. When interpreted as IRRs, β_{1j} and γ_{10} represent the expected change in the frequency of talk to peers with a one-point increase in shyness, β_{2j} and γ_{20} are the expected change with a one-point increase in inhibitory control, and β_{3j} and γ_{30} are the expected change with a one-point increase in ELP.

The following equations specify Model 2, where I added gender, IEP status, and age in months as covariates.

Level-1 (Within Classroom) Model:

$$\eta_{ij} = \beta_{0j} + \beta_{1j}\left(\text{Shyness}_{ij} - \overline{\text{Shyness}_{.j}}\right) + \beta_{2j}\left(\text{InhibCont}_{ij} - \overline{\text{InhibCont}_{.j}}\right) + \beta_{3j}\left(\text{ELP}_{ij} - \overline{\text{ELP}_{.j}}\right) + \beta_{4j}\text{Gender}_{ij} + \beta_{5j}\text{IEP}_{ij} + \beta_{6j}\left(\text{Age}_{ij} - \overline{\text{Age}_{.j}}\right)$$

Level-2 (Between Classroom) Model:

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

$$\beta_{2j} = \gamma_{20}$$

$$\beta_{3j} = \gamma_{30}$$

$$\beta_{4j} = \gamma_{40}$$

$$\beta_{5j} = \gamma_{50}$$

$$\beta_{6j} = \gamma_{60}$$

In this model, I hold gender, IEP status, and age constant when looking at the effect of shyness, inhibitory control, and ELP. For example, β_{1j} is the log of the change in the outcome associated with a one-point deviation of child *i*'s shyness from classroom *j*'s average shyness, holding

constant inhibitory control, ELP, gender, IEP status, and age. The IRRs for β_{4j} and γ_{40} represent the expected difference in the frequency of talk to peers between boys (coded as 0) and girls (coded as 1). The IRRs for β_{5j} and γ_{50} represent the expected difference in the frequency of talk to peers between children without IEPs (coded as 0) and children with IEPs (coded as 1), holding constant all other variables in the model. The IRRs for β_{6j} and γ_{60} represent the expected change in the frequency of talk to peers with a one-month increase in age, holding constant all other variables in the model.

For Model 3, I added CLASS Instructional Support ratings in the level-2 equation.

Level-1 (Within Classroom) Model:

$$\eta_{ij} = \beta_{0j} + \beta_{1j}\left(\text{Shyness}_{ij} - \overline{\text{Shyness}_{.j}}\right) + \beta_{2j}\left(\text{InhibCont}_{ij} - \overline{\text{InhibCont}_{.j}}\right) + \beta_{3j}\left(\text{ELP}_{ij} - \overline{\text{ELP}_{.j}}\right) + \beta_{4j}\text{Gender}_{ij} + \beta_{5j}\text{IEP}_{ij} + \beta_{6j}\left(\text{Age}_{ij} - \overline{\text{Age}_{.j}}\right)$$

Level-2 (Between Classroom) Model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{CLASS}_j) + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

$$\beta_{2j} = \gamma_{20}$$

$$\beta_{3j} = \gamma_{30}$$

$$\beta_{4j} = \gamma_{40}$$

$$\beta_{5j} = \gamma_{50}$$

$$\beta_{6j} = \gamma_{60}$$

In this model, γ_{01} represents the expected change in a classroom's frequency of talk to peers for every one-point increase in classroom quality.

Additional interaction analyses explored whether overall classroom instructional quality moderated the relationship between the amount of children's talk and their shyness, inhibitory control, or English proficiency. In other words, was there a stronger effect of shyness, inhibitory control, or ELP on children's classroom language use in classrooms with certain levels of

quality? I tested these interaction effects in separate models at level 2, adding classroom quality to the equation for shyness (β_{1j}), inhibitory control (β_{2j}), or ELP (β_{3j}). For example, the following model tests the interaction between classroom quality and shyness.

Level-1 (Within Classroom) Model:

$$\eta_{ij} = \beta_{0j} + \beta_{1j}\left(\text{Shyness}_{ij} - \overline{\text{Shyness}_{.j}}\right) + \beta_{2j}\left(\text{InhibCont}_{ij} - \overline{\text{InhibCont}_{.j}}\right) + \beta_{3j}\left(\text{ELP}_{ij} - \overline{\text{ELP}_{.j}}\right) + \beta_{4j}\text{Gender}_{ij} + \beta_{5j}\text{IEP}_{ij} + \beta_{6j}\left(\text{Age}_{ij} - \overline{\text{Age}_{.j}}\right)$$

Level-2 (Between Classroom) Model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{CLASS}_j) + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(\text{CLASS}_j)$$

$$\beta_{2j} = \gamma_{20}$$

$$\beta_{3j} = \gamma_{30}$$

$$\beta_{4j} = \gamma_{40}$$

$$\beta_{5j} = \gamma_{50}$$

$$\beta_{6j} = \gamma_{60}$$

The interaction effect is represented by γ_{11}, which, interpreted as an IRR, is the expected change in the regression coefficient for shyness (β_{1j}) for every one-unit increase in classroom quality.

RQ2: **What variability can be seen in the amount of teacher language directed toward individual children in preschool classrooms and the repertoire of language types (e.g., requests, repetition, direction, decontextualized language) that teachers use?** For Research Question 2, I investigated the frequency and repertoire of language that teachers directed toward each focal child. Observers recorded instances of lead teacher language separately from assistant teachers' language, but because the current study is interested in children's experiences rather than individual teachers' behavior, most analyses in the current study combine lead and assistant teachers' talk to determine whether *any* teacher spoke to the child or used a given category of talk during each cycle. Previous studies have found similarities

in lead and assistant teachers' language use (Atkins-Burnett et al., 2011; Gest et al., 2006). See Appendix C for a brief investigation into several differences between lead and assistant teacher talk, which are beyond the scope of the current study. Descriptive analyses examined how frequently teachers spoke to focal children (i.e., how many cycles contained teacher talk to the focal child, how much teacher talk occurred in English versus Spanish). I also analyzed teachers' use of all language categories measured by the LISn (i.e., repeats/confirms the focal child's utterance, elaborates/builds on the focal child's utterance, gives directions, requests contextualized language, provides contextualized information, provides/elicits decontextualized language, reads, sings, or engages in other talk) to see which occurred most and least often.

I calculated correlations among the various teacher language categories. Together, these findings are used to describe teachers' average language use across all classrooms. Finally, I present ICCs and box plots of each teacher-talk outcome variable to begin illustrating variability across classrooms.

Sub-RQ2a: To what extent is this variability related to children's characteristics (i.e., shyness, inhibitory control, and English/Spanish language proficiency) or classroom quality (i.e., CLASS Instructional Support ratings)? I started by examining correlations between the teacher-talk outcomes and predictors/covariates, as well as between the child-talk and teacher-talk outcomes. Then I used multilevel models to examine the relationship between children's characteristics and how often teachers spoke to them using each category of teacher talk. There were ten outcome variables in this section, each based on the number of cycles in which the following occurred: overall frequency of teacher talk to focal child; teachers repeated/confirmed child's speech; teachers elaborated on child's speech; teachers gave directions; teachers requested language from the child; teachers used contextualized language to

provide information/label; teachers used decontextualized language or requested it from the child; teachers read; teachers used English; and teachers used Spanish. Teacher-talk outcome variables were modeled using a similar procedure as the child-talk outcomes. I added a covariate in Model 2 to account for variability in how much children spoke to their teachers (i.e., the number of cycles in which the child talked to his/her teacher).

CHAPTER 3

Children's Classroom Language Use and Its Relationship with Child Characteristics (RQ1)

This chapter reviews findings related to children's language use in their classrooms. I examine their talk to teachers and peers, including engagement in sustained conversations, and use of English and Spanish. I describe and compare frequencies for each type of child talk, review correlations among them, and then explore between-classroom variability. Finally, I investigate within-classroom differences, focusing on the relationship between children's talk and their characteristics and classroom quality.

Descriptive Analyses of Child Talk

Looking at the frequency of focal children's talk in any language (i.e., either English or Spanish), as shown in the righthand column of Table 5, a few patterns begin to emerge. Children spoke to other children in 37.2% of the observation cycles, on average, whereas they spoke to their teachers (combined lead and assistants) in an average of 15.5% of cycles. Paired samples *t*-tests indicate that differences between children's talk to peers and teachers was statistically significant. As hypothesized, children spoke more to their peers, on average, than they did to their teachers, $t(116) = 12.04$, $p < .001$. Minimum and maximum percentages provide additional descriptive information about children's experiences. For example, all children spoke in at least 12% of their observation cycles. The minimum percentage of child talk to teachers, however, was zero. Some children ($n = 22$) never spoke to their lead teachers during the observation, and some ($n = 15$) never spoke to their two assistant teachers, but only one child never spoke to any of her three teachers, suggesting that the majority of children are talking to at least one teacher in their classroom.

Table 5

Percentage of Cycles with Focal Child Talk, by Language (n = 117)

Category of talk	English		Spanish or mixed		Any language	
	Mean % of cycles (SD)	Min – Max	Mean % of cycles (SD)	Min – Max	Mean % of cycles (SD)	Min – Max
Focal child talks to lead teacher	5.82 (6.24)	0 – 28	0.19 (0.9)	0 – 8	6.01 (6.36)	0 – 28
Focal child talks to asst. teachers (comb.)	9.27 (8.01)	0 – 40	0.31 (1.26)	0 – 7	9.58 (8.07)	0 – 40
Focal child talks to any teacher	15.02 (10.06)	0 – 47	0.5 (1.64)	0 – 8	15.50 (10.08)	0 – 47
Focal child talks to another child	36.1 (15.22)	3 – 83	1.05 (2.61)	0 – 17	37.16 (15.32)	3 – 83
Total cycles with focal child talk	48.6 (15.72)	12 – 83	1.54 (3.75)	0 – 25	50.04 (15.61)	12 – 83

Note. Focal child talks to asst. teachers (comb.) captures child talk to both assistant teachers combined.

There was substantial variability in the frequency of focal children's talk during the observations. Histograms reveal a fairly normal distribution of children's talk to peers (Figure 7), whereas their talk to teachers was positively skewed, with two peaks (Figure 8).

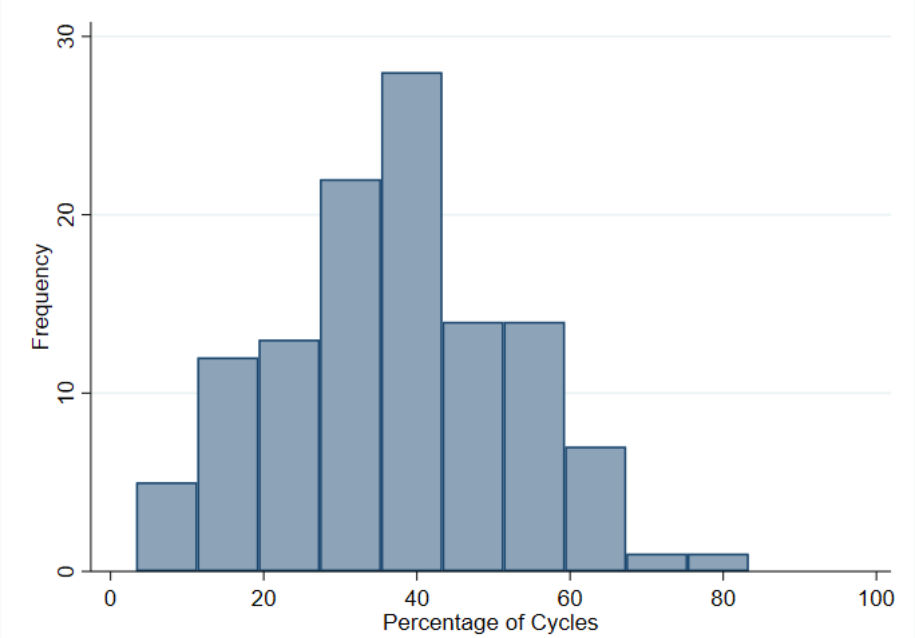

Figure 7. Histogram of child talk to peers

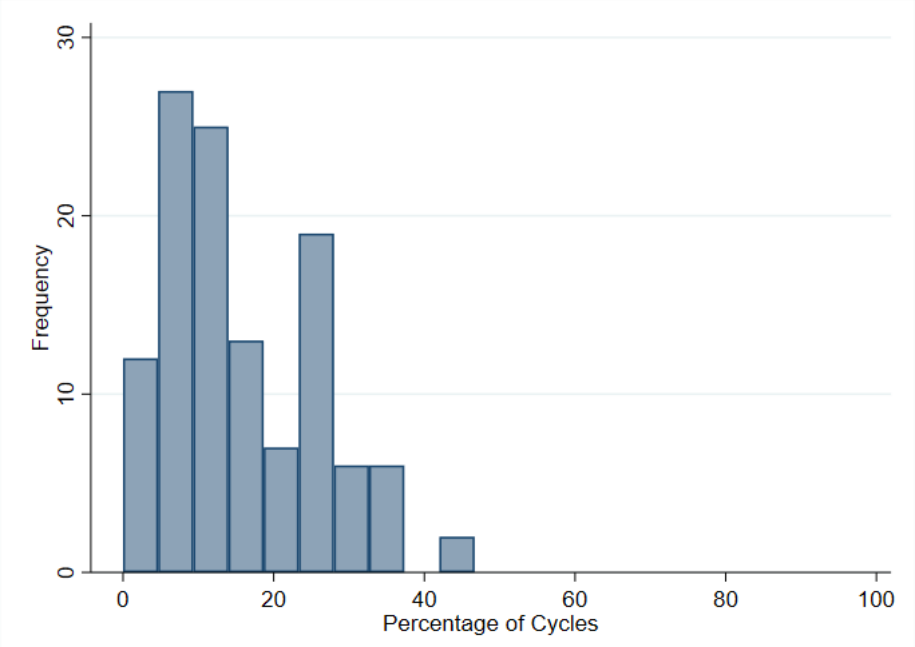

Figure 8. Histogram of child talk to teachers

The range of children's talk to peers was also much larger than their range of talk to teachers. This may have occurred in part because children had approximately 16 other children they could talk to, as opposed to only three teachers. Some children spoke to their peers in as much as 83% of the observation (i.e., 50 of the 60 cycles), whereas the child who talked the most to his teachers did so in 47% (i.e., 29 cycles). Only five children spoke to their teachers in more than 20 cycles, which is a third of the observation period. Analyses in a subsequent section examine how child language use varied by classroom.

I used a pairwise correlation to investigate the possibility that some children talked more and some talked less—regardless of their conversational partner. There was no observed correlation, however, between individual children's frequency of talk to teachers and peers (r = -.14), which suggests that children who talk frequently to teachers are not talking frequently to peers, and vice versa. There is no relationship between the frequency of children's talk to peers and their talk to teachers. This correlation and others will be discussed further in a later section.

In examining children's talk to the different teachers in their classrooms, it appeared that children spoke more to their assistant teachers than they did to the lead teacher, $t(116) = 3.73$, $p < .001$. All classrooms, however, had two assistant teachers and only one lead teacher in the classroom at any given time, so this finding is difficult to interpret. In fact, after dividing children's talk to assistant teachers in half to account for the two assistants in each room, there was no longer a significant difference between children's amount of talk to lead vs. assistant teachers, $t(116) = -1.73$, $p = .087$. See Appendix C for a brief investigation into several differences between children's talk with lead and assistant teachers. Subsequent analyses combine lead and assistant teachers into one category (i.e., teachers) for the purposes of interpretability.

Children used English in the classroom far more than they used Spanish, $t(116) = 30.68$, $p < .001$ ($M = 48.6\%$ versus 1.54% of cycles, respectively). This was true both for talk with peers, $t(116) = 24.37$, $p < .001$, and talk with teachers, $t(116) = 15.26$, $p < .001$. This finding was expected, given that the classrooms conducted most instruction in English.

Children's sustained conversations. Children's classroom language use was also evaluated based on the number of sustained conversations they participated in with the lead teacher, assistant teachers, or other children. A conversation was considered sustained if there were more than two conversational turns (e.g., Child-Teacher-Child-Teacher-Child). This kind of extended discourse on a single topic is important for children's language development; engaging in back-and-forth interactions helps develop vocabulary and discourse skills, as children learn to correct misunderstandings and negotiate meaning with their conversational partner (Dickinson & Tabors, 2001). On average, children had two sustained conversations during the 30 minutes they were observed (see Table 6).[10] Most children had either no sustained conversations ($n = 47$) or one sustained conversation ($n = 35$) with their teachers; the same was true for conversations with peers ($n = 52$ and $n = 33$, respectively). Paired samples *t*-tests did not yield statistically significant differences in the number of sustained conversations children had with teachers versus children ($p = .642$). Based on the previous finding that children talked more to their peers than their teachers, it may seem as though they should have had more sustained conversations with their peers as well. However, sustained conversations required the continued participation

[10] At the end of each 5-minute snapshot, the observer tallied how many sustained conversations had occurred with each type of partner (i.e., lead teacher, assistant teachers, other children); per snapshot, the LISn allowed for the child to be coded as having 0, 1, or "more than 1" conversation with each type of partner. I converted "more than 1" to 2 for analytic purposes, but it is possible that a child could have had a snapshot with 3 or more sustained conversations with a partner type. This likely occurred infrequently, if at all, due to the short observation period. The "more than 1 sustained conversation" box was checked 57 times out of a possible 2,100. Some children had this box checked more than once, such that 38 children had at least one snapshot in which they had more than one sustained conversation with a given type of conversational partner (i.e., lead teacher, assistant teachers, or other children). The number of sustained conversations for these 38 children may therefore be slightly underestimated.

of both the focal child and a conversational partner for more than two turns; teachers were probably more likely than peers to engage in turn-taking, ask questions, and respond to the focal child's utterances.

Table 6

Frequency of Sustained Conversations per 30-Minute Observation

	Mean	*SD*	Min	Max
With teachers	1.20	1.37	0	6
With another child(ren)	1.11	1.44	0	7
Total sustained conversations	2.31	2.00	0	7

Note. n = 117. With teachers is a sum across lead and two assistant teachers; With another child(ren) represents sustained conversations with one or more peer; Total sustained conversations is a sum of all conversations across all teachers and children.

Correlations of Child Talk

Not surprisingly, some measures of child talk were correlated with one another. As shown in Table 7, the two measures of children's talk to teachers were highly correlated—the percentage of cycles that children talked to any of their teachers and the number of sustained conversations they had with any teacher. These correlations suggest that some children were more talkative with their teachers than other children. Children who talked more regularly with their teachers also had more sustained conversations with them, and vice versa.

Table 7

Pearson's Correlation Coefficients Among Child-Talk Variables

	1	2	3
1. Percentage of cycles that focal child talks to any teacher	—		
2. Number of sustained conversations with any teacher	.60***	—	
3. Percentage of cycles that focal child talks to another child	-.14	-.09	—
4. Number of sustained conversations with peer	-.12	.01	.57***

*** $p < .001$.

Correlations between variables measuring children's talk to teachers and their talk to peers help determine if those children who talked frequently to teachers were also talking frequently to peers. There were no correlations, however, between children's talk to teachers and

their talk to peers. This suggests that some children are talkative with their teachers and some are talkative with their peers, but they are not the same children. Consistent with the fact that the various measures of child talk to teachers were correlated with one another, I found that both measures of child talk to peers were correlated with each other. This indicates that children who talk more frequently to peers are also having more sustained conversations with them.

These correlations may reveal more about the teachers or their classroom climate than they do about the children themselves. There may be some classrooms in which children are more encouraged to talk with their teachers, which could result in more frequent child talk to teachers and more sustained conversations with them. Conversely, there may be classrooms in which children have more opportunities to interact with their peers, thereby increasing their frequency of talk to peers and their sustained peer conversations.

Between-classroom Variability in Child Talk

Intraclass correlations (ICCs). Using intraclass correlations derived from unconditional linear mixed models, I estimated the proportion of variance in children's talk that could be explained by differences between classrooms. These ICCs suggested that approximately 5-14% of the variance in the child-talk outcome variables was accounted for by variation between classrooms. This indicates that there were mild cluster effects, such that children in some classrooms spoke more than children in other classrooms. It also indicates that children's talk was correlated with their classmates' talk, likely because they shared some common classroom-level random effects. There were slightly higher ICCs for variables that measured children's talk to peers than those that measured their talk to teachers. This was true for the number of cycles that children talked to peers (ICC = .13, SE = .08) versus teachers (ICC = .09, SE = .08), and for the number of sustained conversations with peers (ICC = .14, SE = .09) versus with teachers

(ICC = .08, SE = .08). This suggests that there is more between-classroom variance in the amount of child talk to peers than there is in the amount of child talk to teachers. There was also a slightly lower ICC for the frequency of children's English talk (ICC = .05, SE = .07) than for their Spanish talk (ICC = .09, SE = .08), suggesting slightly more between-classroom variance in children's Spanish language use. Because all ICCs were non-zero and statistically significant, a multilevel modeling approach was appropriate for these data, as this shows classroom membership accounted for some variance in children's amount of talk. The boxplots on the following pages display some of the specific differences in the distribution of child talk across classrooms, which are arranged in ascending order by their median values.

Frequency of talk to teachers. Figure 9 shows boxplots of the percentage of cycles in which the focal child talked to any teacher in the classroom.

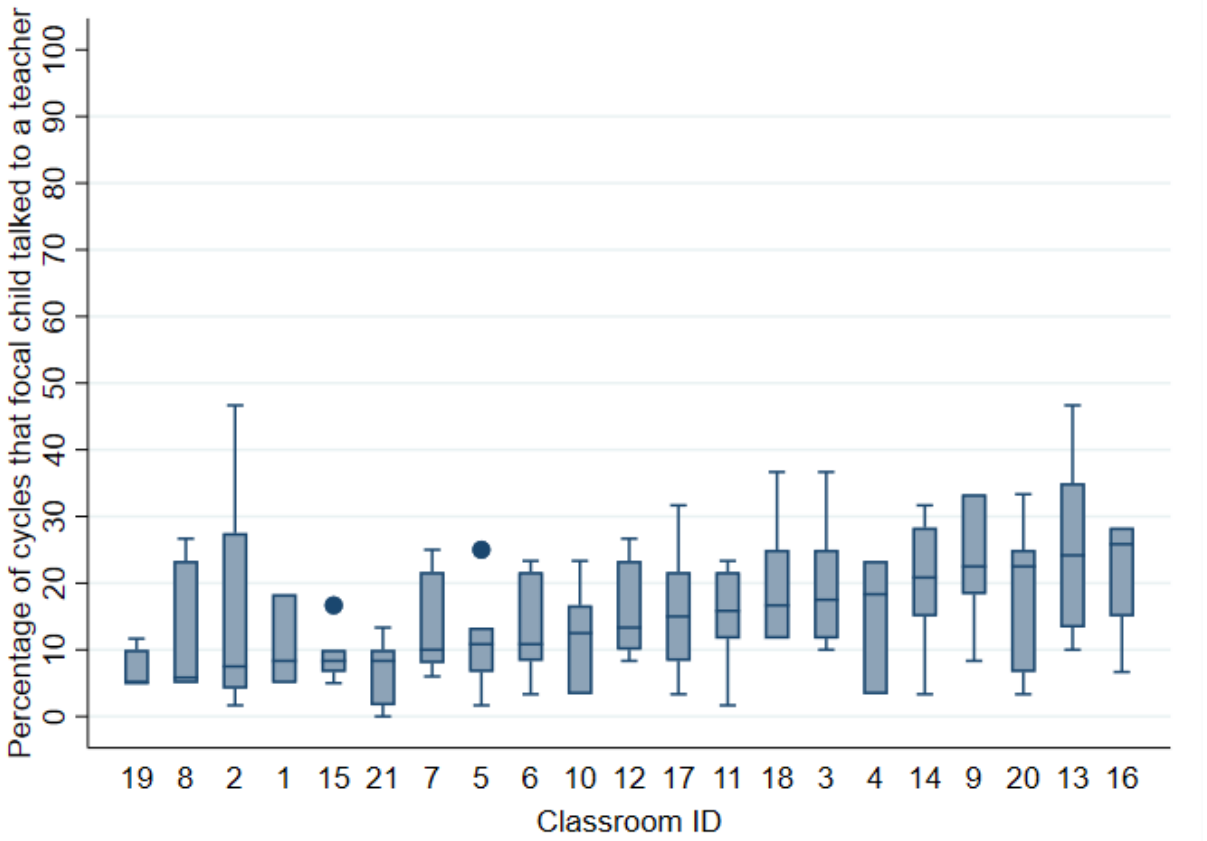

Figure 9. Percentage of cycles that focal children in each classroom talked to a teacher, arranged by classroom median

Some classrooms, such as Room 19, have a narrow range—all children in that room spoke to their teachers in 5.0 – 11.7% of the observation. Across all classrooms, this classroom had the lowest median amount of child talk to teachers, at 5% of the observational cycles. In fact, all children in Room 19 spoke to their teachers less than the overall sample median (13.3%). Other classrooms, such as Room 2, had a wider range of child talk to teachers (1.7 – 46.7% of the observation), but the classroom median, 7.5%, was still low. Some children in Room 2 spoke very little to their teachers and one spoke to them quite regularly. Classrooms with higher median values had various patterns of child talk to teachers, some positively skewed and some negatively skewed.

It appears that individual children may drive some between-classroom variability, either due to inherent differences in their behavior or to differences in the affordances their teachers provide for them. For example, in addition to the aforementioned child in Room 2, classrooms 5 and 15 each had an outlier who spoke to teachers substantially more than other children in the classroom; these are represented in the figure as circles. In both Room 2 and Room 15, the child who talked most to teachers had an IEP for a speech or language impairment. In each classroom, it is possible that the child's frequency of talk to teachers was related to his impairment, or that his teachers intentionally provided him with more opportunities to talk than his classmates. Most likely, it was due to some combination of both—a bidirectional relationship between child and teacher behavior. The next section will investigate other child-level factors that may have contributed to how much individual children talked in their classrooms.

Sustained conversations with teachers. As shown in Figure 10, there was also between-classroom variability in the number of sustained conversations children had with their teachers.

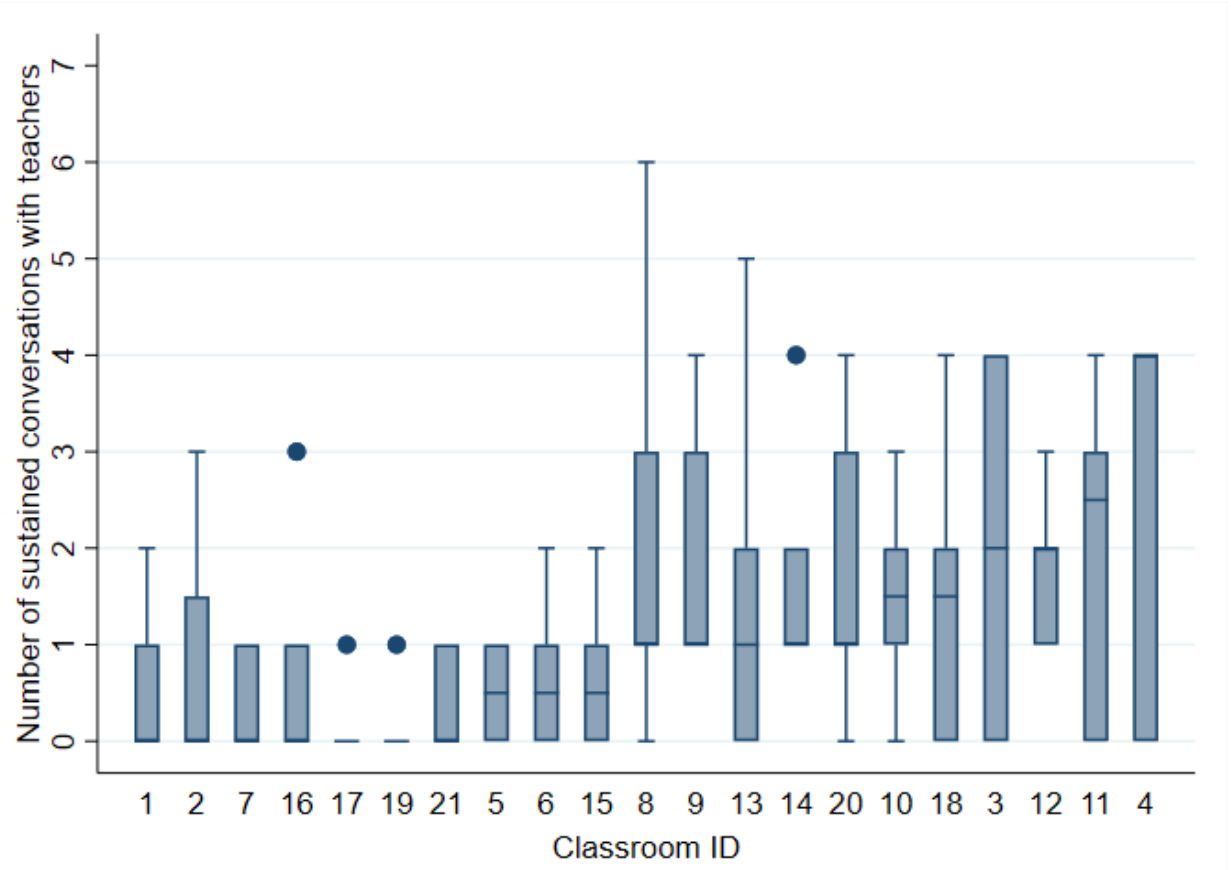

Figure 10. Number of sustained conversations with teachers, arranged by classroom median

The median number of conversations in seven classrooms was zero, indicating that most children in those classrooms did not have any sustained conversations with their teachers. Rooms 2 and 19—which we learned had lower frequencies of child talk to teachers in Figure 9—both had few sustained conversations as well, which is not surprising considering the correlation between these two variables (r = .6). In both classrooms, only one child had any sustained conversations with a teacher; in Room 2, the child who spoke most frequently to teachers also had three sustained conversations with them. In the remaining fourteen classrooms, at least half the children had one or more sustained conversation with a teacher. In three classrooms—Rooms 9, 14, and 12—all focal children had at least one conversation with a teacher during the observation period. Room 12 had the most equally distributed number of sustained conversations, suggesting that children were not engaging in markedly more conversations than

their classmates. The distribution of classrooms in Figure 10 reveals important variability in the frequency of sustained teacher-child interactions. Ideally, all classrooms would look like those on the righthand side of the figure. Differences between the classrooms on the left versus right side of the figure might be related to child, teacher, or classroom characteristics, which I begin to explore in the next section. The differences are likely not due to variation in which activity settings were observed (e.g., we might expect to see more sustained conversations during free play, when teachers can spend more one-on-one time with children), because all classrooms were observed during a similar portion of their daily schedule.

Frequency of talk to peers. Figure 11 examines the frequency of children's talk to peers. The classroom median ranges from 18.3% of the observation cycles to 53.3%. Some classrooms had narrow ranges, meaning that all children talked to their peers in a similar number of cycles. For example, children in Room 14 talked to their peers in 41.7 – 55.0% of the observation cycles. In contrast, children in Room 7—which had a similar classroom median—talked in as few as 6% of the cycles to as many as 66.6%. Overall, as was demonstrated with a slightly higher ICC, children's talk to peers was more correlated within classroom than their talk to teachers. Differences in medians across classrooms are also more evident in Figure 11 than in the boxplots of children's talk to teachers (Figure 9).

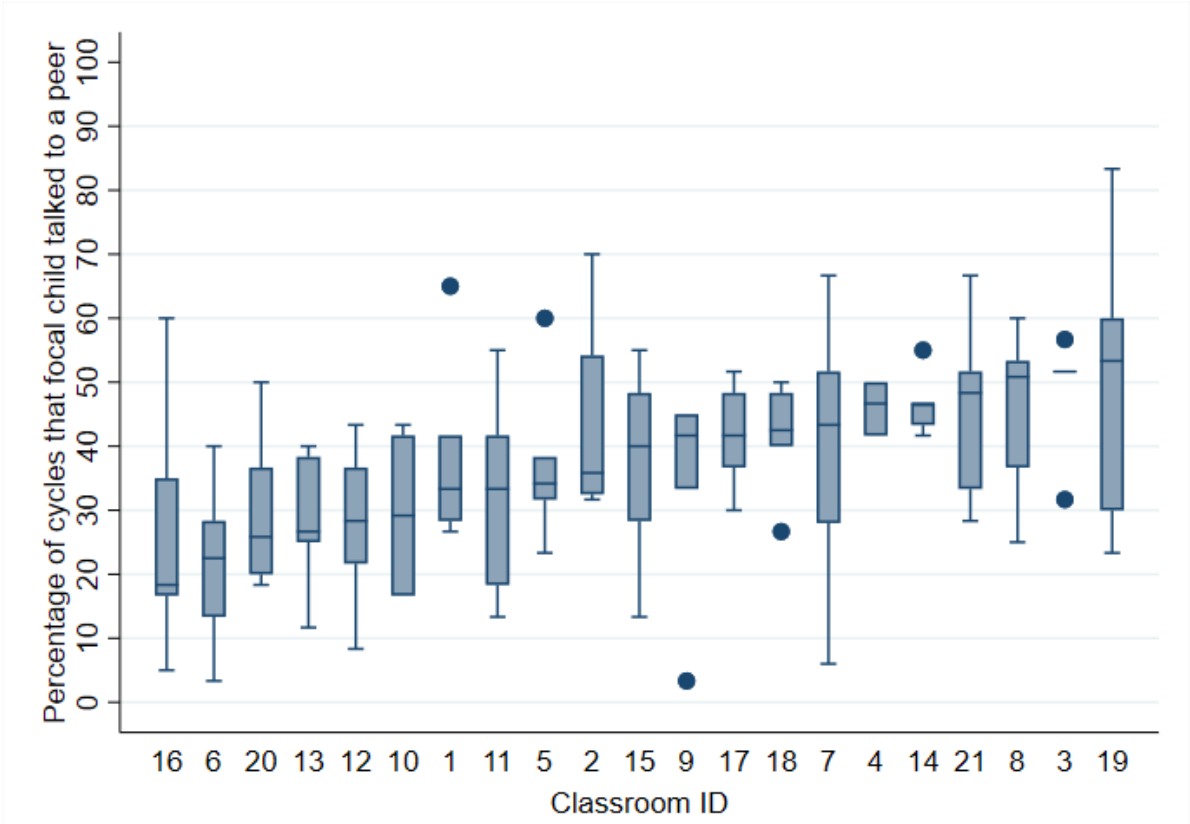

Figure 11. Percentage of cycles that focal child talked to a peer, arranged by classroom median

Sustained conversations with peers. As seen in Figure 12, the distribution of boxplots for children's sustained conversations with peers is similar to the distribution of boxplots for their conversations with teachers (Figure 10). Approximately half the classrooms are clustered on the low end, with most children having zero or one sustained conversations with their peers. In some classrooms, children had few conversations with both teachers and peers—Rooms 1, 7, and 17, for example, had a median of zero for both. In other classrooms where children had few sustained conversations with teachers—such as Room 21—children engaged in more sustained conversations with their peers. As with the other boxplots, there were outliers in some classrooms; for example, in Room 9, three children had zero sustained conversations with peers, two children had one conversation, and one child had six.

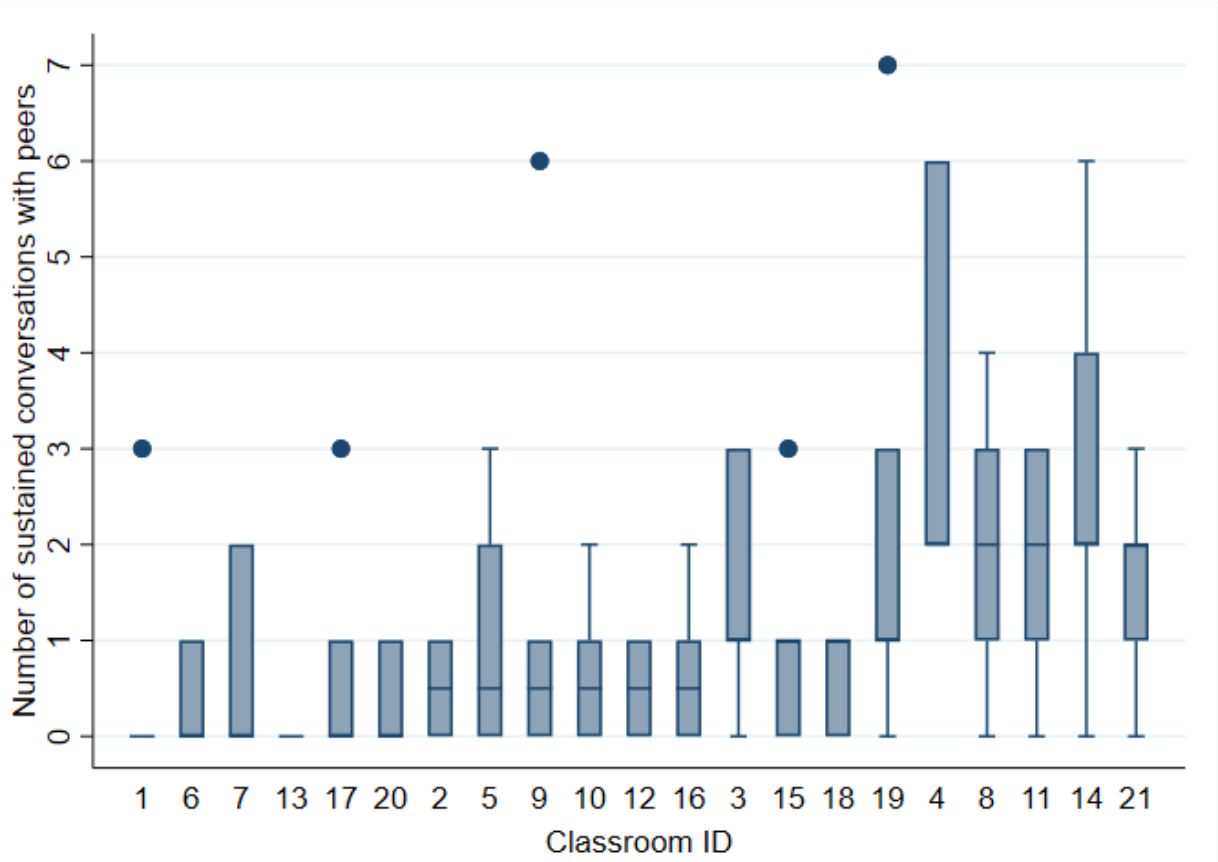

Figure 12. Number of sustained conversations with peers, arranged by classroom median

Relationships between Children's Talk and their Characteristics and Classroom Quality (Sub-RQ1a)

Based on the descriptive analyses described in the previous section, I anticipated that both child-level and classroom-level factors would contribute to each child's talk, as there were clear within-classroom and between-classroom differences for each outcome variable. This section examines the extent to which the amount of child talk was related to children's characteristics (e.g., shyness, inhibitory control, English/Spanish language proficiency) or classroom quality.

Investigations described in the previous section indicated that several child-talk variables did not follow a normal distribution, thus rendering OLS regression inappropriate. Shapiro-Wilk

tests (Shapiro & Wilk, 1965) confirmed that four outcome variables were positively skewed: the frequency of child talk to teachers ($W = 0.95$, $p < .001$), the number of sustained conversations with teachers ($W = 0.90$, $p < .001$), the number of sustained conversations with peers ($W = 0.86$, $p < .001$), and the frequency of Spanish talk ($W = .99$, $p < .001$). The remaining outcome variables were normally distributed: frequency of talk to peers ($W = 0.99$, $p = .865$) and frequency of English talk ($W = 0.67$, $p = .682$). To model all outcome variables, I used negative binomial regression, which is a type of generalized linear model used for non-negative count data, similar to Poisson regression. Negative binomial models account for the aforementioned nonnormality, and they enable modeling of non-continuous outcome variables that could have occurred in a limited number of intervals. For all outcome variables, multilevel modeling accounted for the between-classroom variance explored in the previous section (Level-1, $n = 117$ children; Level-2, $n = 21$ classrooms).

Correlations among child characteristics. Before proceeding with the multilevel models, I conducted bivariate correlations among all the predictors and covariates: children's background characteristics (i.e., shyness, inhibitory control, English and Spanish proficiency scores, age in months, gender, and whether the child had an IEP) as well as classroom instructional support, as shown in Table 8.

The strongest correlations were between inhibitory control and children's other characteristics (i.e., English and Spanish proficiency scores, age, and being a girl). There were also correlations between age and English language proficiency, and between Spanish language proficiency and being a girl. Shyness, IEP status, and classroom quality were not correlated with any other predictors.

Table 8

Correlations among Child Characteristics and Classroom Quality (n = 117)

	Shyness	Inhib. control	ELP	SLP	Age	Classroom Quality	Gender
Inhibitory control	.16	--					
English proficiency score	-.15	.21*	--				
Spanish proficiency score	.02	.27**	.02	--			
Age in months	-.07	.19*	.26**	.05	--		
Classroom quality	-.06	.11	.13	-.01	.10	--	
Gender – Female	-.01	.39***	.12	.22*	.04	.11	--
IEP	.08	-.06	-.02	.03	-.08	.01	-.06

* $p < .05$. ** $p < .01$. *** $p < .001$.

Correlations between child talk and predictors. Next I conducted bivariate correlations between children's background characteristics (i.e., shyness, inhibitory control, English and Spanish proficiency scores, age in months, gender, and whether the child had an IEP) and each of the child-talk outcome variables (i.e., frequency of talk to teachers, sustained conversations with teachers, frequency of talk to peers, sustained conversations with peers, and frequency of English and Spanish talk), as shown in Table 9.

Table 9

Correlations between Child Characteristics and Child-Talk Variables (n = 117)

	Talk to teachers	Sustained conv. with teachers	Talk to peers	Sustained conv. with peers	English talk	Spanish talk
Shyness	-.27**	-.10	-.13	.07	-.23*	-.15
Inhibitory control	-.21*	-.04	.07	.18*	-.07	.07
English proficiency score	.09	.09	.19*	.16	.28**	-.20*
Spanish proficiency score	-.02	.10	.05	.02	-.04	.39***
Age in months	.11	.15	.04	.03	.13	-.12
Classroom quality	.18	.08	-.09	-.08	.03	.05
Gender – Female	-.09	-.06	.05	.27**	-.04	.19*
IEP	-.08	-.17	.03	-.03	.00	-.08

* $p < .05$. ** $p < .01$. *** $p < .001$.

Several predictors were correlated with the child-talk outcome variables. For example, shyness was negatively correlated with the frequency of children's talk to teachers and with their

overall amount of talk in English. Inhibitory control was negatively correlated with children's talk to teachers, but positively correlated with the number of sustained conversations they had with peers. Age in months, classroom quality, and IEP status were not significantly correlated with any child talk-outcome variables. All predictors were included in the models. The continuous level-1 predictors—shyness, inhibitory control, English proficiency, and age—were group-mean centered. For two models—the frequency of children's talk in English and in Spanish—I also included group-mean centered Spanish proficiency as a level-1 predictor.

Investigation of outliers. There were two outliers in terms of English proficiency scores (0 and 1 out of 100 points), and these children's frequency of speech was in the bottom 5% of the sample (i.e., they spoke in 6 and 15 cycles out of 60, respectively). This suggested that they may be leverage points, so I conducted sensitivity analyses to determine if my findings would change if I removed these children from the sample. See Appendix D for the full analyses. There were several differences, most notably that there were statistically significant or marginally significant positive associations between children's English proficiency and their frequency of talk to teachers and peers when the two outliers remained in the sample, but not when they were removed. In this section, I present findings with the full sample of 117 children, because I do not want to exclude children with the very lowest English proficiency scores. While these children's experiences may not be generalizable, it is important to document their language use and exposure and how it may be related to their characteristics. I discuss the findings for both samples whenever the sensitivity analyses identified a difference.

Frequency of talk to teachers. The first set of analyses examines the frequency of children's talk to teachers, as measured by the number of cycles in which they spoke to any teacher in their classroom (see Table 10).

Table 10

Results of Multilevel Negative Binomial Models Predicting Child Talk to Teachers

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.833 (.057)	.008	.870 (.051)	.018	.866 (.051)	.015
Inhibitory control	.786 (.072)	.009	.775 (.068)	.004	.781 (.068)	.005
English proficiency	1.005 (.003)	.112	1.006 (.003)	.038	1.006 (.003)	.035
Gender – Female			1.032 (.111)	.769	1.017 (.109)	.873
IEP			.807 (.125)	.167	.811 (.125)	.174
Age (in months)			.994 (.012)	.589	.993 (.012)	.565
Teacher requests for lang.			1.075 (.013)	.000	1.075 (.013)	.000
Level 2 Fixed effect:						
Instructional support					1.165 (.094)	.058
Variance estimate of random effect:						
Classroom	.063 (.040)		.072 (.038)		.054 (.032)	
Wald χ^2	18.69	.000	61.28	.000	64.08	.000
df	6		10		11	
AIC	721.20		697.81		696.49	
BIC	737.78		725.43		726.88	

Note. The outcome variable is the number of cycles in which the child talked to a teacher. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 117$; classrooms, $n = 21$.

Results for this negative binomial regression model are expressed as incidence-rate ratios (IRRs), which compare the rate at which child talk to teachers occurred across values of each predictor. The first model looks only at the effect of the key level-1 predictors—parent-teacher composite ratings of children's shyness and inhibitory control, and children's English proficiency scores on the *pre*LAS, all group-mean centered—while accounting for any between-classroom variance. The Wald χ^2 test of model fit indicated that the model as a whole was significantly different from a null model. Examining the level-1 fixed effects, there was a significant effect of shyness and inhibitory control, but not of English proficiency. Holding English proficiency and inhibitory control constant, when children's shyness increased, there

was a reduction in the amount of child talk to teachers. Similarly, when children's inhibitory control increased, there was a reduction in the amount of child talk to teachers, holding English proficiency and shyness constant.

In Model 2, I added four level-1 covariates: gender, whether the child had an IEP, age in months, and the frequency of teachers' requests for child language. There was no effect of gender, IEP, or age, but the frequency of teachers' requests for child language was a significant predictor of the amount of child talk to teachers. In addition, after accounting for these covariates, English proficiency emerged as a significant predictor; children with higher English proficiency spoke more to their teachers. This association, however, was not found in the sensitivity analysis after removing the outliers. I also compared Akaike's and Bayesian information criteria (AIC and BIC, respectively) between each model to detect improvements in model fit. Smaller values indicate relatively better model fit; adding the level-1 covariates (i.e., gender, age, IEP status, and the frequency of teacher requests for language) substantially improved the model.

For Model 3, I added the level-2 predictor—classroom instructional quality, as measured by the CLASS Instructional Support domain. While AIC and BIC did not improve substantially, I interpret the results of this model as the final model for consistency across investigations of all outcome variables and to capture the combined associations among all predictors and covariates. In this final model, there was a significant effect of children's shyness, inhibitory control, and English proficiency, and the frequency of teacher requests for language. Shyness had an IRR of .866, meaning that for every one-point increase in shyness, there was a 13.4% decrease in the rate of children's talk to their teachers, holding constant all other variables in the model. For every one-point increase in inhibitory control, there was a 21.9% decrease in the rate of

children's talk to their teachers, holding all other variables constant. With every 10-point increase in English proficiency, while holding all other variables in the model constant, there was a 6.2% increase in the rate of children's talk to teachers.[11] This finding should be interpreted with caution, due to the sensitivity analyses. For every additional cycle that teachers requested language from the child, there was a 7.5% increase in the rate of children's talk to teachers, holding all other variables constant. The effect of classroom quality did not reach statistical significance at $\alpha = .05$ ($p = .058$), but the incidence rate ratio of 1.165 indicates a practically significant small effect. For every one-point increase in Instructional Support, there was a 16.5% increase in the rate of children's talk to their teachers, while holding all other variables constant.

Interactions with classroom quality. I also examined possible interactions between classroom instructional quality and the key level-1 predictors (i.e., shyness and ELP) by adding an interaction term to Model 3. An interaction effect would suggest that the relationship between children's characteristics and their classroom talk was dependent on the quality of the classroom. There was a significant interaction between shyness and classroom quality (IRR = 1.230, $p = .001$), such that the effect of children's shyness on their amount of talk to teachers was moderated by classroom quality, as shown in Table 11.

[11] The IRR represents the coefficient for a one-point increase in English proficiency (on the *pre*LAS scale of 0-100). To aid in interpretability, I converted that to a ten-point increase by calculating the IRR to the power of 10.

Table 11

Results of Multilevel Negative Binomial Model with Interaction Effect of Shyness and Classroom Quality on Child Talk to Teachers

	IRR (SE)	*p*
Level 1 Fixed effects:		
Shyness	.417 (.098)	.000
Inhibitory control	.758 (.064)	.001
English proficiency	1.006 (.003)	.046
Gender – Female	1.013 (.104)	.898
IEP	.742 (.112)	.048
Age	1.002 (.012)	.843
Teacher requests for language	1.074 (.013)	.000
Shyness x Instructional support	1.230 (.079)	.001
Level 2 Fixed effect:		
Instructional support	1.185 (.094)	.031
Variance estimate of random effect:		
Classroom	.054 (.031)	

Note. The outcome variable is the number of cycles in which the child talked to teachers. Incidence rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. Students, $n = 117$; classrooms, $n = 21$.

Post-estimation tests revealed that, in classrooms with lower classroom quality (CLASS Instructional Support ratings of 2 or 3), shy children were less likely to talk to their teachers than non-shy children, as shown in Figure 11. For instance, when Instructional Support was rated 2, for every one-point increase in shyness, there was a 36.9% decrease in the rate of child talk to teachers. When Instructional Support was rated 3, this effect reduced in magnitude, such that there was a 22.4% decrease in the rate of child talk to teachers for every one-point increase in shyness. In higher-quality classrooms (i.e., CLASS Instructional Support of 4 or 5), however, there was no statistically significant effect of shyness. In other words, shy children in higher-quality classrooms did not speak any less frequently to their teachers than their more extroverted peers.

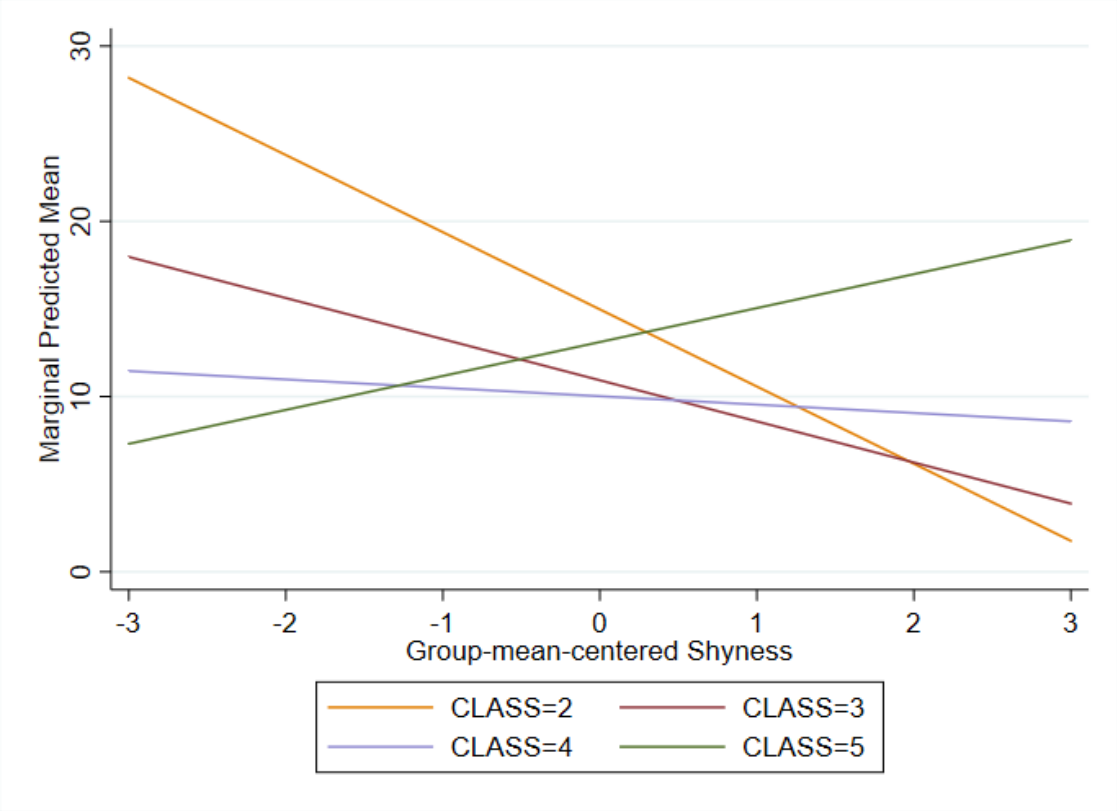

Figure 13. Interaction between children's shyness and classroom quality on the frequency of child talk to teachers. The CLASS scale ranges from 1 to 7, with 7 being the highest quality. The classrooms in this study were rated 2-5 in terms of Instructional Support.

There were not statistically significant interactions between classroom quality and inhibitory control or English language proficiency.

Sustained conversations with teachers. The number of sustained conversations children had with teachers was associated with their English proficiency, as shown in Table 12. I followed the same model-building procedures as I did for the previous outcome variable. In Model 1, the χ^2 test of model fit indicated that the overall model was not significant, and none of the predictors were statistically significant. The AIC and BIC improved in Model 2, with the addition of gender, IEP status, age, and the frequency of teacher requests for child language. English proficiency, IEP status, and teacher requests were all significant predictors of the number of sustained conversations children had with teachers. The higher children's English

proficiency, the more sustained conversations they had. Children with IEPs had fewer sustained conversations with teachers than their peers without IEPs. When teacher requests for language increased, so did children's sustained conversations with them.

Table 12

Results of Multilevel Negative Binomial Models Predicting Sustained Conversations with Teachers

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.878 (.112)	.308	.958 (.108)	.706	.958 (.109)	.704
Inhibitory control	.983 (.173)	.921	.989 (.172)	.948	1.001 (.176)	.996
English proficiency	1.011 (.007)	.100	1.012 (.006)	.039	1.012 (.006)	.037
Gender – Female			.947 (.197)	.795	.930 (.196)	.731
IEP			.474 (.179)	.048	.484 (.183)	.055
Age (in months)			.998 (.023)	.928	.997 (.023)	.902
Teacher requests for lang.			1.124 (.028)	.000	1.124 (.028)	.000
Level 2 Fixed effect:						
Instructional support					1.118 (.159)	.431
Variance estimate of random effect:						
Classroom	.158 (.145)		.157 (.119)		.145 (.116)	
Model Wald χ^2	4.27	.234	29.97	.000	30.45	.000
df	6		10		11	
AIC	357.41		340.95		342.33	
BIC	373.98		368.57		372.71	

Note. The outcome variable is the number of sustained conversations the child had with teachers. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 117$; classrooms, $n = 21$.

In the final model (Model 3), children's English proficiency and the frequency of teacher requests for language were significant predictors of the number of sustained conversations children had with teachers. For every ten-point increase in English proficiency, there was a 12.7% increase in the rate of children's sustained conversations with teachers, holding constant child shyness, inhibitory control, gender, IEP status, age, the frequency of teacher requests for language, and classroom quality. For every additional cycle that teachers requested language

from children, there was a 12.4% increase in the rate of children's sustained conversations with teachers, holding all other variables in the model constant. Although not significant at $\alpha = .05$ ($p = .055$), the strong association between children's IEP status and the number of sustained conversations they had with teachers was practically significant. Children with IEPs had sustained conversations with teachers at a rate 51.6% lower than children without IEPs, holding all other variables constant. Tests of interaction effects between classroom quality and the level-1 predictors were not significant.

Frequency of talk to peers. As shown in Table 13, the χ^2 tests of model fit indicated that none of the models of children's talk to peers were significant.

Table 13

Results of Multilevel Negative Binomial Models Predicting Child Talk to Peers

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.940 (.045)	.193	.939 (.045)	.193	.939 (.045)	.193
Inhibitory control	1.027 (.069)	.694	1.015 (.077)	.844	1.013 (.077)	.869
English proficiency	1.005 (.002)	.043	1.005 (.002)	.059	1.005 (.002)	.060
Gender – Female			1.027 (.091)	.762	1.037 (.092)	.682
IEP			1.054 (.125)	.656	1.060 (.125)	.625
Age (in months)			1.003 (.010)	.728	1.004 (.010)	.719
Level 2 Fixed effect:						
Instructional support					.945 (.055)	.327
Variance estimate of random effect:						
Classroom	.023 (.017)		.023 (.018)		.021 (.017)	
Model Wald χ^2	7.40	.060	7.84	.250	8.82	.266
df	6		9		10	
AIC	864.39		869.98		871.03	
BIC	880.96		894.84		898.65	

Note. The outcome variable is the number of cycles in which the child talked to peers. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 117$; classrooms, $n = 21$.

The AIC and BIC worsened with each model, suggesting that the added predictors did not contribute to model fit. Because none of the predictors were significant, it appears that variance in the frequency of children's talk to peers was related to factors that are not included in this model (i.e., aspects of child behavior, teacher practice, or classroom context that were not measured in the current study).

There was a marginally significant relationship between children's English proficiency and the frequency of their talk to peers. In the final model, with every 10-point increase in English proficiency, while holding all other variables in the model constant, there was a 5.1% increase in the rate of children's talk to peers. This relationship should be interpreted with caution not only because it was not statistically significant ($p = .060$), but also because the p-value increased substantially ($p = .283$) when the two outliers were removed in the sensitivity analyses (see Appendix D). It seems, therefore, that this marginal effect was driven by children with the lowest English proficiency—children who also talked infrequently to their peers. This suggests that English language proficiency may only be related to a child's frequency of talk to peers for children with particularly low English proficiency.

Sustained conversations with peers. In terms of children's sustained conversations with peers, both English proficiency and gender were significant predictors, as shown in Table 14. Children with higher levels of English proficiency engaged in more sustained conversations (in any language) with their peers. In the final model, for every 10-point increase in children's English proficiency, there was a 14.9% increase in the rate of their sustained conversations with peers, while holding all other variables constant. Again, this relationship did not hold during the sensitivity analyses. Girls had more sustained conversations with their peers than boys did. Girls' rate of sustained conversations with peers was more than twice that of boys, holding the other

variables constant. All three models fit the data well, but Model 2 fit best, suggesting that classroom quality did not add valuable information in Model 3.

Table 14

Results of Multilevel Negative Binomial Models Predicting Sustained Conversations with Peers

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.961 (.131)	.771	.972 (.129)	.828	.974 (.129)	.844
Inhibitory control	1.266 (246)	.226	.978 (.203)	.916	.965 (.199)	.863
English proficiency	1.015 (.007)	.022	1.014 (.006)	.034	1.014 (.006)	.031
Gender – Female			2.193 (.538)	.001	2.278 (.563)	.001
IEP			.875 (.287)	.683	.888 (.291)	.718
Age (in months)			1.000 (.026)	.990	1.000 (.027)	.999
Level 2 Fixed effect:						
Instructional support					.768 (.158)	.199
Variance estimate of random effect:						
Classroom	.305 (.190)		.401 (.215)		.357 (.198)	
Model Wald χ^2	8.62	.035	19.70	.003	20.88	.004
df	6		9		10	
AIC	340.22		335.81		336.19	
BIC	356.79		360.67		363.82	

Note. The outcome variable is the number of sustained conversations the child had with peers. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 117$; classrooms, $n = 21$.

Children's English and Spanish language use. The previous analyses combined children's English and Spanish talk to examine children's overall language use to teachers and peers. This section analyzes both languages separately. Children's Spanish proficiency was added as a predictor in each of the models.

First, I examined the frequency of children's talk in English to either teachers or peers. As shown in Table 15, English proficiency was the only significant predictor of how much children spoke in English.

Table 15

Results of Multilevel Negative Binomial Models Predicting Child Talk in English

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.931 (.032)	.035	.936 (.032)	.054	.936 (.032)	.053
Inhibitory control	.936 (.047)	.185	.931 (.050)	.184	.931 (.050)	.188
English proficiency	1.006 (.002)	.000	1.006 (.002)	.001	1.006 (.002)	.001
Spanish proficiency	.999 (.001)	.479	.999 (.001)	.468	.999 (.001)	.470
Gender – Female			.999 (.062)	.985	.997 (.062)	.958
IEP			1.017 (.085)	.843	1.017 (.085)	.841
Age (in months)			1.006 (.007)	.381	1.006 (.007)	.384
Teacher requests for lang.			1.007 (.007)	.333	1.007 (.007)	.336
Level 2 Fixed effect:						
Instructional support					1.011 (.040)	.788
Variance estimate of random effect:						
Classroom	.010 (.008)		.010 (.008)		.009 (.008)	
Model Wald χ^2	23.06	.000	25.79	.001	25.83	.002
df	7		11		12	
AIC	851.90		857.72		859.65	
BIC	871.24		888.101		892.79	

Note. The outcome variable is the number of cycles in which the child spoke in English to either teachers or peers. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 117$; classrooms, $n = 21$.

In the final model, for every ten-point increase in English proficiency, there was a 6.2% increase in the child's rate of talk in English, holding all other variables in the model constant. There was a marginally significant effect of shyness ($p = .053$); for every one-point increase in shyness, there was a 6.4% decrease in the rate of children's English-language talk, holding all other variables constant.

For modeling children's Spanish talk, the sample only included children who were assessed using the Spanish *pre*LAS ($n = 87$), which was presumably the sample of children who

were exposed to Spanish in the home and therefore might have used Spanish in the classroom.[12] As shown in Table 16, shyness, Spanish proficiency, and age were statistically significant predictors of children's Spanish language use. English proficiency was marginally significant, at $p = .071$ in the final model.

Table 16

Results of Multilevel Negative Binomial Models Predicting Child Talk in Spanish

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.570 (.161)	.046	.564 (.154)	.036	.552 (.152)	.031
Inhibitory control	1.576 (.689)	.298	1.813 (.843)	.201	1.825 (.846)	.194
English proficiency	.972 (.013)	.030	.977 (.013)	.074	.977 (.013)	.071
Spanish proficiency	1.039 (.014)	.005	1.031 (.014)	.020	1.031 (.013)	.018
Gender – Female			1.300 (.626)	.586	1.245 (.606)	.652
IEP			.675 (.466)	.569	.710 (.494)	.622
Age (in months)			.889 (.048)	.030	.890 (.048)	.031
Teacher requests for lang.			1.033 (.059)	.570	1.030 (.059)	.602
Level 2 Fixed effect:						
Instructional support					1.182 (.366)	.590
Variance estimate of random effect:						
Classroom	.165 (.410)		.468 (.465)		.464 (.461)	
Model Wald χ^2	17.17	.002	24.52	.002	24.55	.004
df	7		11		12	
AIC	232.94		234.30		236.01	
BIC	250.20		261.42		265.60	

Note. The outcome variable is the number of cycles in which the child spoke in Spanish to either teachers or peers. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 87$; classrooms, $n = 21$.

In the final model, for every one-point increase in shyness, there was a 44.8% decrease in the rate of children's Spanish-language talk, holding constant inhibitory control, English and

[12] Teachers spoke Spanish at least once during all but one classroom observation; this classroom had only one focal child who was exposed to Spanish in the home. This suggests that teachers were open to using Spanish in the classroom, as per agency policy.

Spanish proficiency, gender, IEP status, age, frequency of teacher requests for language, and classroom quality. For every ten-point increase in Spanish proficiency, there was a 35.7% increase in the child's rate of Spanish talk, holding all other variables constant. The marginally significant finding for English proficiency suggests that there is an opposite relationship (p = .071); for every ten-point increase in English proficiency, there was a 20.8% decrease in the child's rate of talk in Spanish, holding all other variables constant. Finally, when age in months increased by one month, there was an 11.0% decrease in the child's rate of Spanish talk, holding all other variables constant.

CHAPTER 4

Teachers' Classroom Language Use and Its Relationship with Child Characteristics (RQ2)

In this chapter, I describe teacher talk to focal children. I examine the frequency of overall teacher talk and the frequency of and correlations among the categories of teacher talk captured by the LISn (e.g., repeated focal child's language, gave directions to the focal child, requested language from the child). I then investigate between-classroom and within-classroom variability, paying particular attention to the relationships between children's characteristics and the talk their teachers use with them, and between classroom quality and teacher talk.

Descriptive Analyses of Teacher Talk to Focal Children

Table 17 displays the number and percentage of cycles that focal children were exposed to each category of teacher talk from either their lead teacher or assistant teachers. For example, in 4.44% of the 60 cycles, on average, a teacher repeated what the focal child said, and across all children, teachers repeated children's language in anywhere from 0 – 25% of the cycles.

Table 17

Number and Percentage of Cycles with Categories of Teacher Talk to Focal Children

Category of talk	Mean number of cycles (SD)	Min – Max number	Mean % of cycles (SD)	Min – Max %
Repeats	2.66 (2.70)	0 – 15	4.44 (4.5)	0 – 25
Elaborates	3.58 (3.82)	0 – 15	5.98 (6.35)	0 – 25
Gives directions	9.53 (4.41)	1 – 22	15.94 (7.37)	2 – 37
Requests language	8.69 (5.06)	0 – 24	14.53 (8.45)	0 – 40
Provides information	9.14 (6.23)	0 – 34	15.26 (10.38)	0 – 57
Uses/requests decontext. language	2.15 (3.04)	0 – 15	3.62 (5.12)	0 – 25
Reads	1.13 (2.40)	0 – 10	1.88 (4)	0 – 17
Sings	3.47 (3.71)	0 – 15	5.8 (6.19)	0 – 25
Other talk	0.93 (.1.15)	0 – 5	1.56 (1.93)	0 – 8
English talk, any category	24.59 (7.57)	4 – 42	41.12 (12.64)	7 – 70
Spanish talk, any category	1.61 (2.35)	0 – 11	2.68 (3.91)	0 – 18
Overall talk[a]	25.68 (7.57)	4 – 45	42.93 (12.64)	7 – 75

[a] Overall talk measures cycles in which the teacher(s) used any category, in either English or Spanish.

Teachers talked to focal children in an average of 42.93% of the observation cycles. Some children were only exposed to teacher language in 7% of cycles, and others in as many as 75% of the cycles. Certain LISn categories of talk were more common than others. The frequencies in Table 17 suggest, for example, that on average, teachers gave directions, requested contextualized language, and provided contextualized information more often than they used other categories of talk. A teacher was coded as giving directions if it appeared that she expected a physical response from the child (e.g., "Please put your dirty cup in the bin," "Move away from there," "It's time for listening ears!"). If it seemed that the teacher expected a verbal response, she was coded as requesting language (e.g., "What is this?", "Which one is the blue one?", "Tell her that you're using the ball right now."), which occurred nearly as often as giving directions. Providing information (contextualized) could have included, for example, labeling objects, explaining how to do an activity, or narrating what a child was doing. Reading and other talk, which included exclamations such as, "Good job!" and expressions of politeness such as "Thank you," occurred least frequently. Singing and other talk are not outcome variables of interest, so analyses in the remainder of this chapter exclude them. Teachers used English more than Spanish when talking to focal children, $t(116) = 31.63$, $p < .001$, speaking English in 41.12% of cycles and Spanish in 2.68%, on average.

Teachers spoke, on average, in more cycles than children, $t(116) = 6.34$, $p < .001$. The relatively frequent occurrence of teacher talk to focal children ($M = 42.93\%$ of cycles; $SD = 12.64$) and the less frequent occurrence of child talk to teachers ($M = 15.50\%$ of cycles; $SD = 10.08$) suggests that most teacher talk was not conversational. Teachers were speaking to children, but children may not have had opportunities to respond or engage in extended discourse. This may have occurred in part because teacher talk was coded if it was directed to the

child either alone or in a group. For example, teachers could have asked a group of children a question, expecting a choral response, and the focal child may not have answered.

The ranges displayed in Table 17 suggest that there was variability in the frequency of most categories of teacher talk. Shapiro-Wilk tests examined the normality of each variable's distribution, as shown in Table 18. Aside from giving directions, all categories of teacher talk had positively skewed distributions. Overall teacher talk and talk in English—both of which were composites across all teacher talk categories—were normally distributed.

Table 18

Shapiro-Wilk Tests for Normality of Teacher-Talk Variables

Category of talk	*W*	*p*-value
Repeats	0.872	.000
Elaborates	0.863	.000
Gives directions	0.980	.083
Requests language	0.947	.000
Provides information	0.934	.000
Uses/requests decontextualized language	0.812	.000
Reads	0.803	.000
English talk, any category	0.982	.128
Spanish talk, any category	0.807	.000
Overall talk[a]	0.990	.541

[a] Overall talk measures cycles in which the teacher(s) used any category of language, in English or Spanish.

Correlations among Teacher-Talk Variables

Most categories of teacher talk were correlated with one another, as shown in Table 19. The highest correlation was between repeats and elaborates (r = .65)—both of which involve the teacher responding to what a child has said. There were also high correlations between requesting language and providing information (r = .58), and between requesting language and repeating (r = .53) or elaborating (r = .56) upon what the focal child said. Giving directions was

not significantly correlated with any other teacher-talk variables, and using/requesting decontextualized language was only correlated with provides information (r = .20).

Table 19

Pearson's Correlation Coefficients Among Teacher-Talk Variables (Percentage of Cycles with Each Category of Talk)

	Repeats	Elaborates	Gives directions	Requests language	Provides info.	Uses/ requests decontext. language
Elaborates	.65***					
Gives directions	-.06	-.04				
Requests language	.53***	.56***	.07			
Provides info.	.25**	.40***	.17	.58***		
Uses/req. decont. lang.	.00	.13	-.05	.03	.20*	
Reads	.17	.18	-.11	.38***	.25**	-.09

* $p < .05$. ** $p < .01$. *** $p < .001$.

Between-Classroom Variability in Teacher Talk

Intraclass correlations (ICCs). Intraclass correlations derived from unconditional linear mixed models suggested that approximately 24% of the variance in the frequency of overall teacher talk was accounted for by variation between classrooms (ICC = .243, SE = .098). Notably, the ICCs for most teacher-talk variables were higher than the child talk ICCs, which had ranged from .05 to .14. This suggests that between-classroom differences in teacher talk were more pronounced than between-classroom differences in child talk.

Among most of the categories of teacher talk, approximately 14 – 39% of the variance could be explained by between-classroom differences. For giving directions and elaborating on child speech, neither Stata nor SPSS was able to accurately estimate an ICC, which indicated that the variance in the random effect is close to zero. This suggests that almost none of the variance can be accounted for by differences between classrooms. Instead, differences in teachers' use of directions and elaboration may be more closely associated with child-level variability. Any

interpretation, however, should be taken with caution, as a small level-1 sample per cluster can lead to biased variance estimates (Maas & Hox, 2005). The remainder of teacher-talk variables had larger ICCs, ranging from .14 to .39, as shown in Table 20.

Table 20

Intraclass Correlations for Teacher-Talk Variables

Category of talk	ICC	*SE*
Repeats	.139	.086
Elaborates	--	--
Gives directions	--	--
Requests language	.334	.103
Provides information	.388	.103
Uses/requests decontext. lang.	.209	.092
Reads	.142	.084
English talk	.186	.093
Spanish talk	.279	.098
Overall talk	.243	.098

Note. ICCs were calculated based on the number of cycles with each category of talk.

Frequency of teacher talk. Figure 14 displays boxplots of the percentage of cycles in which teachers talked to focal children.

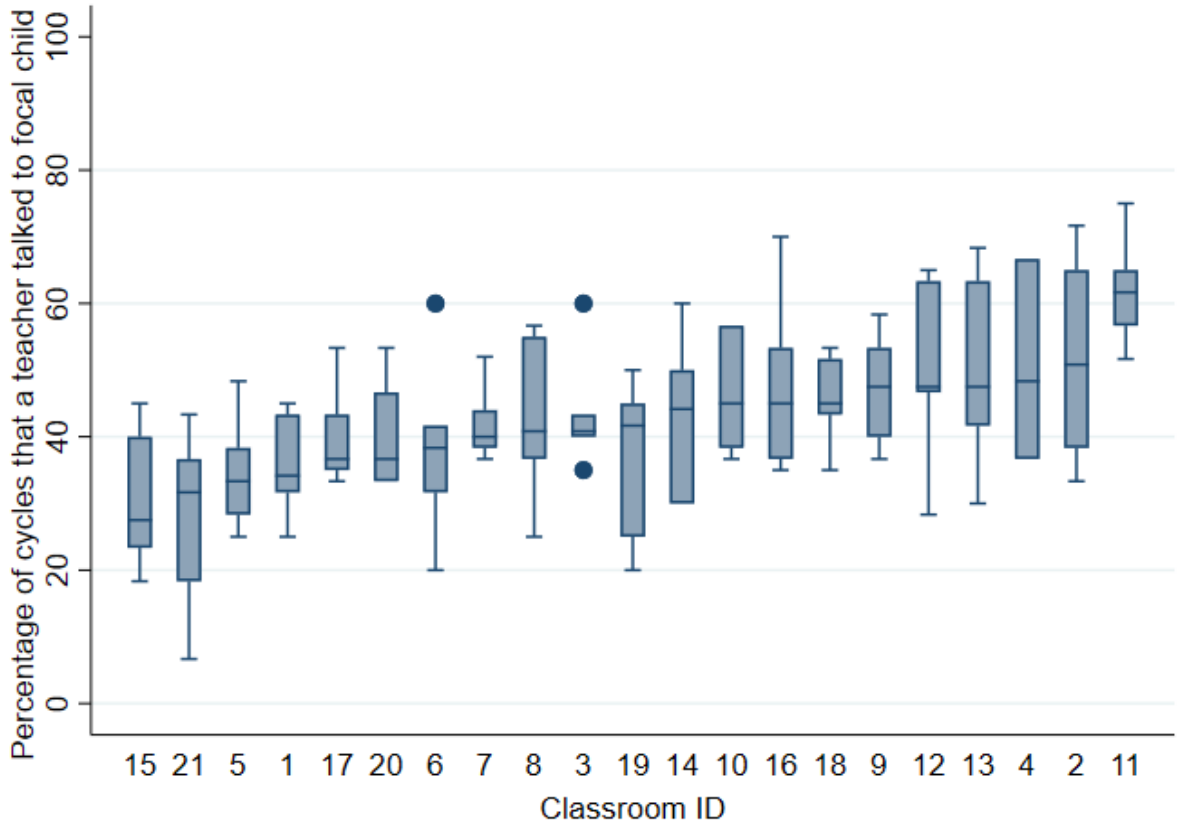

Figure 14. Percentage of cycles that teachers talked to focal child, arranged by classroom median

The medians ranged from 27.5% to 61.7% of cycles across classrooms, and the within-classroom range was fairly consistent. Many classrooms' teacher talk was skewed. For example, in Room 21, the median percentage of teacher talk was 31.7%, but teachers spoke to one child in only 6.7% of the observation cycles. Like some of the previously mentioned children who stood out as potential outliers, this child had an IEP for a speech or language impairment.

Teacher repeats child language. As shown in Figure 15, there was also between-classroom variability in how often teachers repeated children's language.

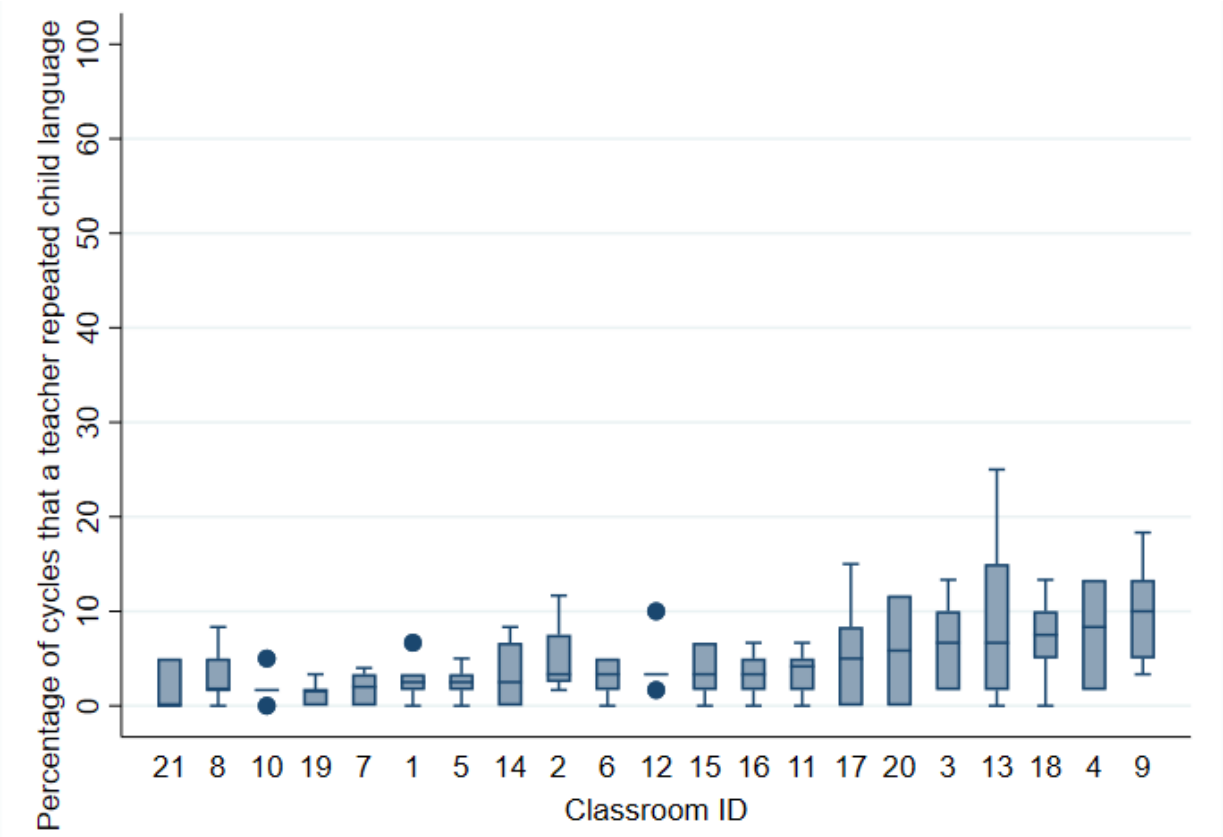

Figure 15. Percentage of cycles that teachers repeated focal child language, arranged by classroom median

Most boxplots include zero, indicating that teachers never repeated the language of at least one child in their classroom. Some classrooms had a narrow range; for example, in Room 11, teachers repeated child language in 0 – 6.7% of cycles. Others had a wider range, such as Room 13, in which teachers repeated child language in 0 – 25% of cycles. Variability in this outcome is inherently linked to children's behavior, because teachers could only repeat children's language if the child spoke. Therefore, within-classroom variability is likely related to how much individual children spoke during the observation period, and between-classroom variability is likely related to how often children had opportunities to speak within a given classroom.

Teacher elaborates on child language. Boxplots of teachers' elaborations on child language show many classrooms with wider within-classroom variation than their repetitions of child language, as shown in Figure 16.

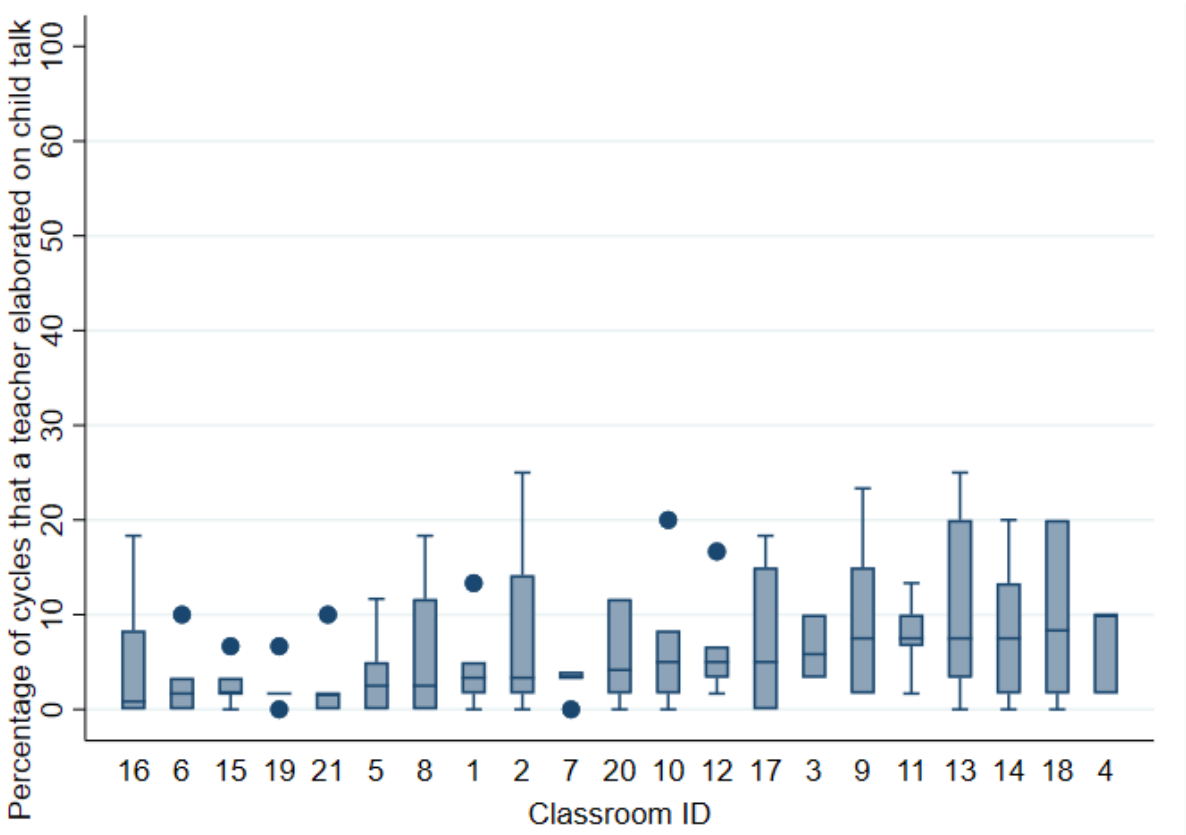

Figure 16. Percentage of cycles that teachers elaborated on focal child language, arranged by classroom median

Many classrooms were skewed such that there were fewer children above the median than below, and seven classrooms had an outlier higher than the classroom median. This suggests that teachers elaborated on the language of some children markedly more than their peers. For example, in Room 16, which had the lowest classroom median, teachers elaborated on one child's language in 18.3% of cycles, whereas they never elaborated on the language of three of his peers and elaborated on the others' in only 1.7% and 8.3% of cycles. Like teacher repeating, some of the within-classroom variability in teacher elaboration may be related to differences in how much children themselves talk. There are other factors at play, however, as illustrated by the

children in Room 16; the child who heard the most teacher elaboration (18.3% of cycles) spoke to teachers the same amount (in 28.3% of cycles) as two children who never heard any teacher elaboration. Analyses in the next section will examine child characteristics that may account for some of these within-classroom differences.

Teacher gives directions. There was also between- and within-classroom variation in how often teachers gave children directions, as shown in Figure 17.

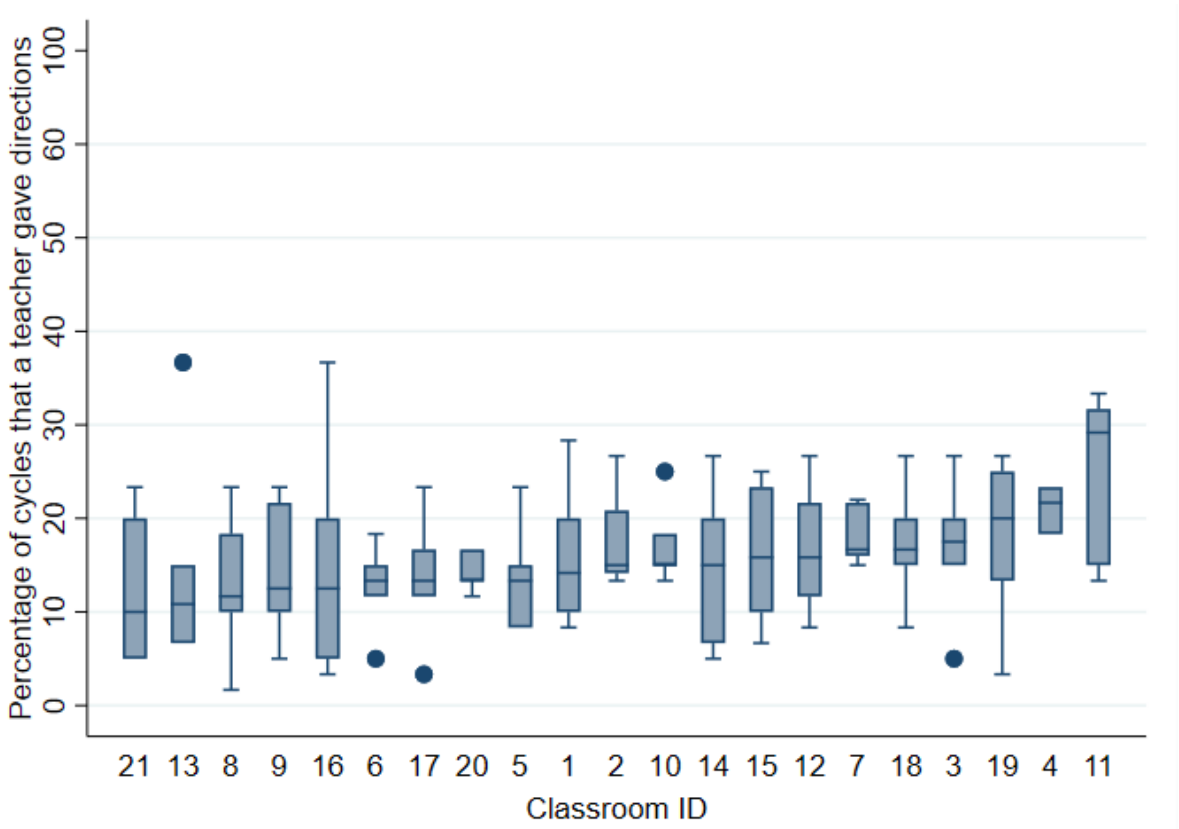

Figure 17. Percentage of cycles that teachers gave directions to focal child, arranged by classroom median

Some classrooms, such as Room 20, had a narrow range, with teachers giving children directions in 11.7 – 16.7% of cycles. Other ranges were wider; in Room 16, teachers gave children directions in 5 – 36.7% of cycles, which resulted in a similar median to Room 20.

Teacher requests for language. There was substantial between-classroom variability in teachers' requests for child language, as shown in Figure 18.

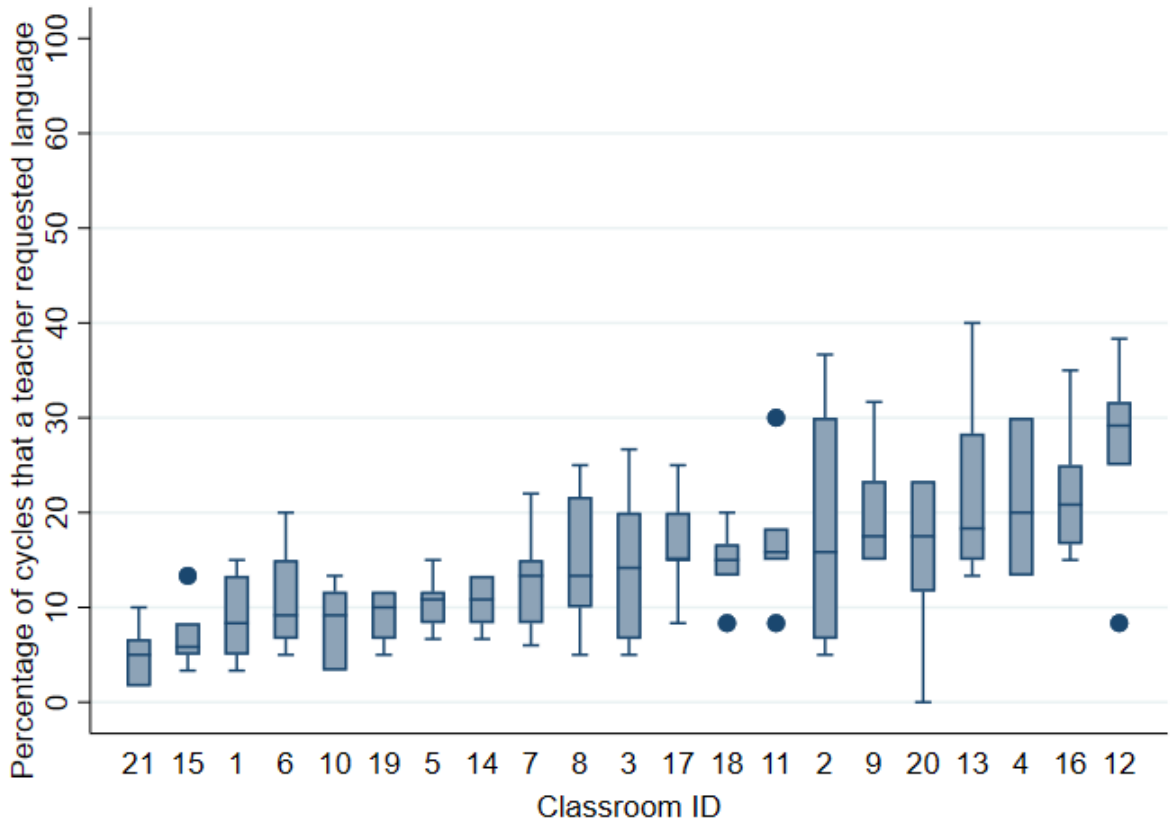

Figure 18. Percentage of cycles that teachers requested focal child language, arranged by classroom median

Classroom medians ranged from 5.0% to 29.2% of cycles. The within-classroom range tended to be larger in classrooms with higher medians, indicating greater variability among children in the amount of language teachers requested. In the classroom in which teachers requested language most often, Room 12, children also had the most consistent sustained conversations with teachers, as seen in Chapter 3 (Figure 7). Teachers in this classroom likely requested language from children repeatedly, which would have encouraged teacher-child conversations to continue for several turns.

Teacher provides contextualized language. There was also quite a bit of between-classroom variability in the frequency of teachers using contextualized language to provide children with information (e.g., labeling), as shown in Figure 19.

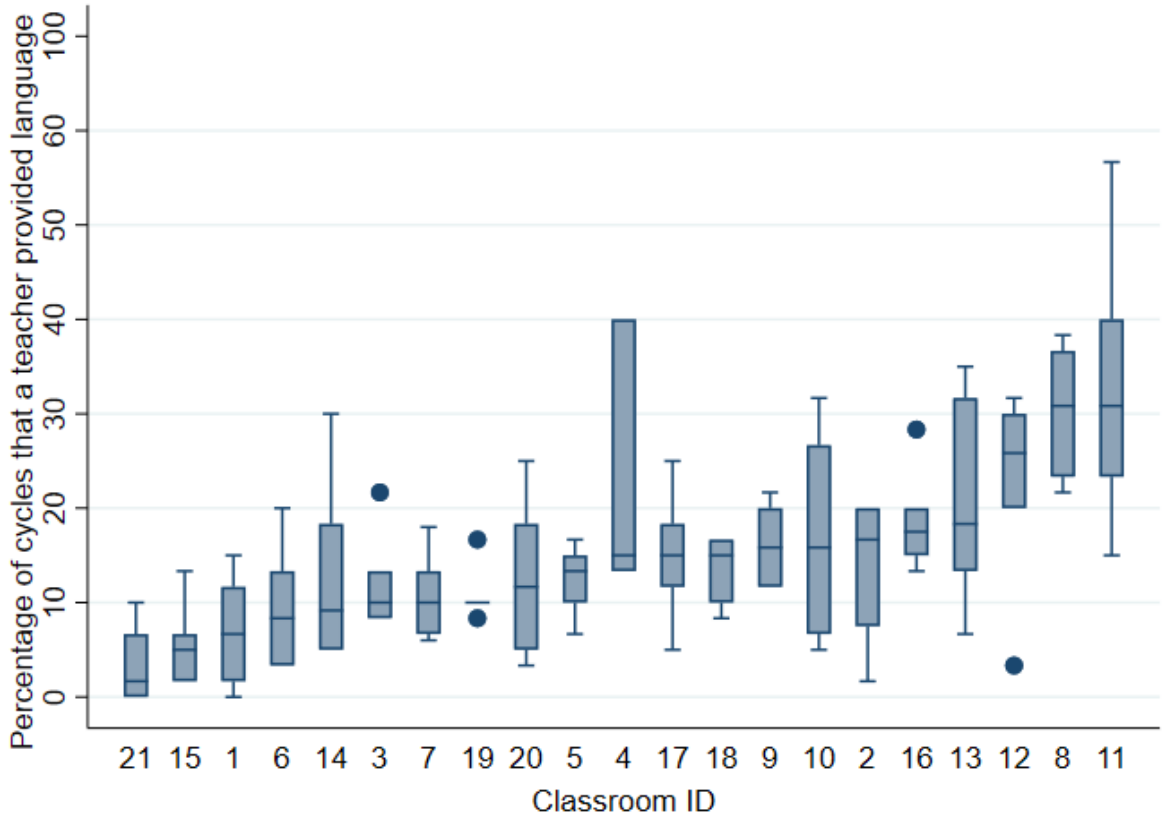

Figure 19. Percentage of cycles that teachers used contextualized language to provide information to the focal child, arranged by classroom median

Classroom medians ranged from 1.7% to 30.1% of cycles. Teachers provided information in at least one cycle for all but three children. Two of these children were in Room 21, which had the lowest median for this and several other teacher-talk categories. Many classrooms were fairly balanced, with the median falling in the middle of the boxplot. Some had narrow ranges, such as Room 8, in which teachers provided information to children in 21.7% to 38.3% of cycles. Others had wider ranges, such as Room 11, which ranged from 15.0% to 56.7% of cycles.

Teacher uses or requests decontextualized language. Teachers used and requested decontextualized language (i.e., abstract language that was not tied to the child's immediate context) less often than the previously discussed categories of teacher talk, as seen in Figure 20.

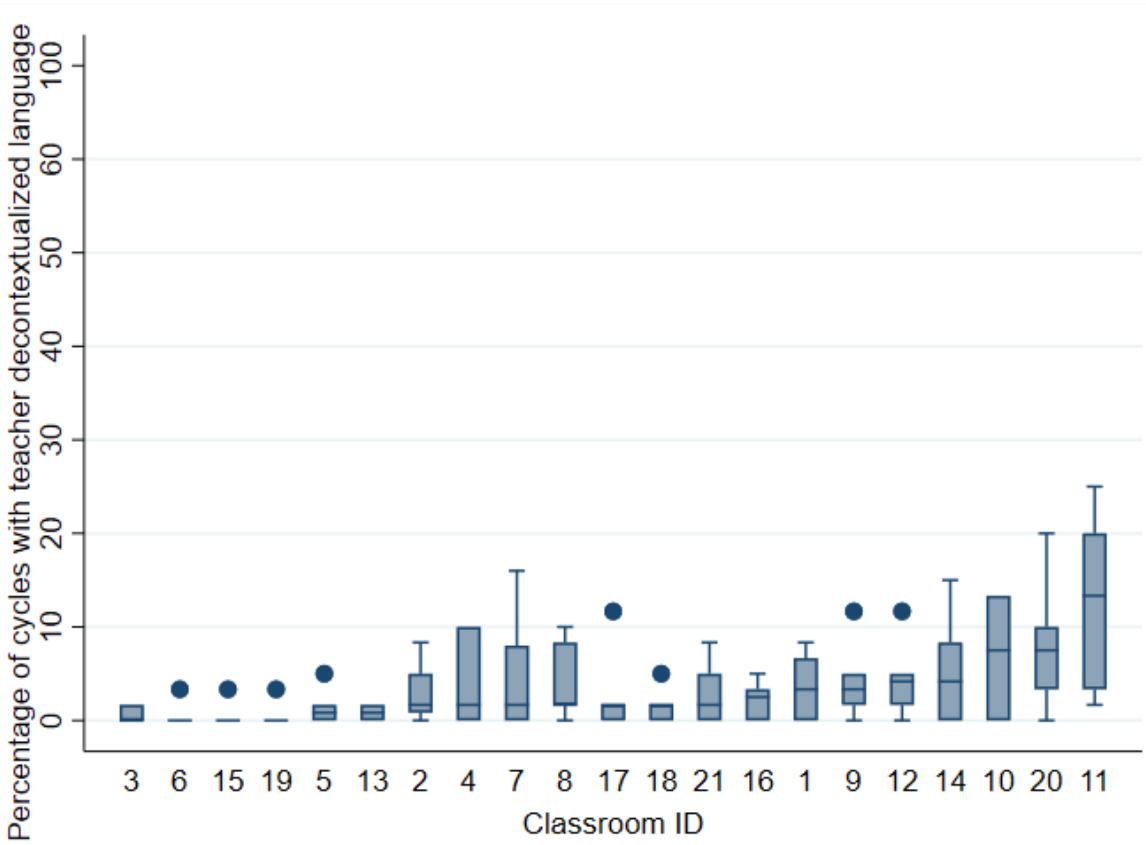

Figure 20. Percentage of cycles that teachers used or requested decontextualized language, arranged by classroom median

Medians ranged from 0.0% to 13.3% of cycles, with median values under 5% for all but three classrooms. Aside from Room 11, for at least one child in each classroom, teachers never used or requested decontextualized language. In Room 11, which had the highest median for this category along with giving directions and using contextualized language, teachers used decontextualized language or requested it from children in 1.7% to 25.0% of cycles.

Teacher reads to focal child. In many classrooms, teachers did not read to focal children during the three-hour observation period, as shown in Figure 21.

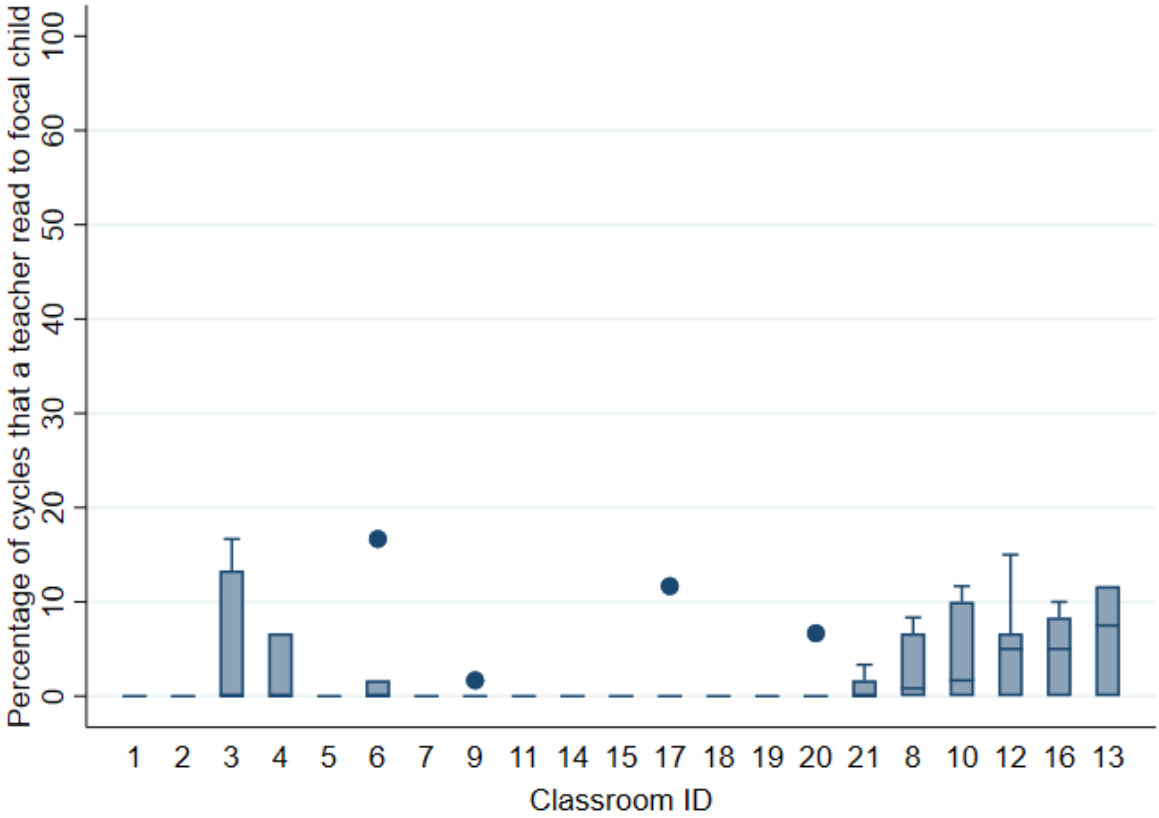

Figure 21. Percentage of cycles that teachers read to focal child, arranged by classroom median

Teachers read to children in twelve classrooms, but they did not read during observation cycles for all focal children, as indicated by the low median values across most of Figure 21. In each classroom, only one to four focal children experienced reading during any of their observation cycles. Teachers read to children most often during whole-group time, when all children were gathered in a circle on a rug in the classroom. Therefore, in many cases, within-classroom variability in reading was based primarily on which children were being observed during the book reading (even though all focal children may have been read to simultaneously). Although circle time was observed in all classrooms, not all classrooms read books during this time, as indicated by the multiple boxplots with no reading.[13] Teachers also occasionally read

[13] Instead of reading during whole group, many classrooms spent that time reviewing the calendar, talking about the weather, singing, and dancing. Observations were conducted towards the end of the school year, so some classrooms were preparing for an end-of-year performance. This, however, should not have precluded them from reading.

independently to children, whether they were reading a book or assisting the child by reading directions on a game, for example.

Relationships between Teacher Talk, Children's Characteristics, and Classroom Quality (Sub-RQ2a)

In this section, I use multilevel negative binomial regression to examine the associations among children's characteristics, classroom quality, and the various teacher-talk categories.

Correlations between teacher talk and predictors. Before conducting regression analyses, I examined pairwise correlations between the teacher-talk outcome variables and possible predictors: the child-talk outcome variables from the previous chapter; child characteristics (i.e., shyness, inhibitory control, English and Spanish language proficiency, age, gender, and whether the child had an IEP); and classroom quality.

As seen in Table 21, there were several statistically significant correlations between the various categories of child and teacher talk. The frequency of child talk was highly correlated with teachers repeating or elaborating on children's language. These two categories of teacher talk could only occur when children spoke, so high correlations were expected. Similarly, child talk to teachers was correlated with teachers requesting language from the child and talking to the child in English (which was the language of most classroom talk). Child talk to teachers was also correlated, to a lesser degree, with teachers providing information and reading. The other variable measuring child talk to teachers—sustained conversations, which was correlated with frequency of child talk—was also correlated with many of the same teacher-talk variables. Children's frequency of talk to peers was negatively correlated with teachers requesting language from children and reading to them, suggesting perhaps that these are mutually exclusive; if teachers are reading to children or requesting language from them, the children cannot be

simultaneously talking with their peers. Finally, child and teacher talk in Spanish were correlated with each other.

Table 22 displays correlations between teacher-talk variables and child characteristics. There is a negative correlation between children's shyness and how often teachers gave them directions. Children's inhibitory control is negatively correlated with teachers' elaboration on child speech. Teacher elaboration is also negatively correlated with being female. Children's Spanish proficiency is correlated with the amount of teacher talk in Spanish. Finally, classroom quality is positively correlated with teachers requesting language from children and reading to them. Regression models include all aforementioned predictors in order to account for potential relationships among variables.

Table 21

Pearson's Correlation Coefficients Between Child-Talk and Teacher-Talk Variables

	Repeats	Elaborates	Gives directions	Requests language	Provides information	Uses/requests decontext. language	Reads	English talk	Spanish talk
Child talk to teachers	0.69***	0.78***	0.03	0.58***	0.34***	0.02	0.29**	0.50***	0.03
Sustained conversations with teachers	0.55***	0.61***	0.06	0.44***	0.42***	0.20*	0.26**	0.41***	0.10
Child talk to peers	-0.08	-0.09	0.16	-0.24**	-0.11	-0.10	-0.31*	-0.10	0.06
Sustained conv. With peers	-0.03	-0.18*	0.12	-0.14	0.01	-0.03	-0.21*	-0.07	0.14
Child overall English talk	0.31***	0.33***	0.12	0.09	0.07	-0.08	-0.13	0.18	-0.05
Child overall Spanish talk	0.09	0.04	0.11	0.11	0.06	0.01	0.04	-0.01	0.56***

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 22

Pearson's Correlation Coefficients Between Child Characteristics, Classroom Quality, and Teacher-Talk Variables

	Repeats	Elaborates	Gives directions	Requests language	Provides information	Uses/requests decontext. language	Reads	English talk	Spanish talk
Shyness	-0.14	-0.16	-0.18*	-0.12	-0.09	0.04	-0.05	-0.17	0.03
Inhibitory control	0.00	-0.21*	-0.15	0.08	0.04	-0.09	-0.04	-0.07	-0.03
English proficiency score	0.01	0.04	0.03	-0.01	-0.15	0.09	-0.13	-0.01	-0.13
Spanish proficiency score	0.15	0.00	0.07	0.15	0.11	0.10	-0.08	0.08	0.34***
Age in months	0.13	0.05	0.01	0.16	0.09	0.13	-0.04	0.11	-0.08
Classroom quality	0.10	0.17	-0.05	0.20*	0.09	-0.08	0.27**	0.09	0.11
Gender – Female	-0.04	-0.24**	-0.03	-0.10	0.02	-0.08	-0.18	-0.11	0.11
IEP	-0.05	-0.05	0.07	-0.04	-0.07	-0.03	-0.03	-0.08	0.08

* $p < .05$. ** $p < .01$. *** $p < .001$.

Frequency of teacher talk. First, I examined the overall frequency of teachers' talk, to investigate whether teachers spoke more to particular children based on children's characteristics, regardless of the category of talk (see Table 23).

Table 23

Results of Multilevel Negative Binomial Models Predicting Overall Teacher Talk

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.933 (.027)	.018	.963 (.026)	.165	.962 (.026)	.162
Inhibitory control	1.005 (.041)	.911	1.055 (.044)	.201	1.057 (.044)	.190
English proficiency	.999 (.001)	.365	.998 (.001)	.078	.998 (.001)	.080
Gender – Female			.962 (.047)	.424	.958 (.047)	.380
IEP			.975 (.066)	.714	.976 (.066)	.718
Age (in months)			1.004 (.005)	.409	1.004 (.005)	.417
Child talk to teachers			1.019 (.004)	.000	1.019 (.004)	.000
Level 2 Fixed effect:						
Instructional support					1.042 (.046)	.352
Variance estimate of random effect:						
Classroom	.021 (.010)		.022 (.010)		.021 (.010)	
Wald χ^2	6.25	.100	29.09	.000	29.87	.000
df	6		10		11	
AIC	803.92		792.87		794.03	
BIC	820.50		820.49		824.41	

Note. The outcome variable is the number of cycles in which any teacher talked to the focal child. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 117$; classrooms, $n = 21$.

Model 1 looks only at the effect of the key level-1 predictors—parent-teacher composite ratings of children's shyness and inhibitory control, and children's English proficiency scores, all group-mean centered—while accounting for any between-classroom variance. The Wald χ^2 test of model fit indicated that the model as a whole was not significantly different from a null model. Children's shyness was a significant predictor of the frequency of teacher talk, but we should hesitate to interpret the coefficient, given that the overall model was not significant.

In Model 2, I added four level-1 covariates—gender, whether the child had an IEP, age in months (group-mean centered), and the child's frequency of talk to his/her teachers (group-mean centered). As demonstrated in the previous chapter, there is a significant association between children's shyness and the frequency of their talk to teachers. In Model 2, once I controlled for how often children talked to their teachers, there was no remaining effect of child shyness on the frequency of teacher talk. Instead, child talk to teachers was the only significant predictor. The more a child talked to his/her teachers, the more the teachers talked to the child. Recall that we cannot determine the directionality of this relationship, and in fact, it is likely bidirectional. AIC decreased in Model 2, and the Wald χ^2 test was statistically significant, suggesting this model was an improvement to model fit. However, the addition of these extra parameters did not improve the model substantially enough to lower BIC.

For Model 3, I added the level-2 predictor—classroom instructional quality, as measured by the CLASS Instructional Support domain. There was no significant relationship between classroom quality and the frequency of teacher talk, and there were few changes to the other predictors' coefficients. Although the model fit decreased slightly from Model 2, I interpret the coefficients from Model 3 in order to account for all the predictors and maintain consistency across the interpretation of all models in this chapter. In this final model, the significant effect of child talk meant that for every additional cycle that the focal child spoke to his/her teachers, there was a 1.9% increase in the rate of teacher talk to the child, holding constant shyness, inhibitory control, English proficiency, gender, IEP status, age, and classroom quality.

Teacher repeats child language. Among the categories of teacher talk, I first examined instances of teachers repeating or confirming the child's language, as modeled in Table 24.

Table 24

Results of Multilevel Negative Binomial Models Predicting Teachers Repeating Child Language

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.860 (.090)	.150	.985 (.076)	.843	.980 (.075)	.792
Inhibitory control	1.100 (.162)	.517	1.562 (.177)	.000	1.578 (.180)	.000
English proficiency	1.001 (.006)	.883	.994 (.004)	.155	.994 (.004)	.154
Gender – Female			.868 (.121)	.308	.857 (.119)	.266
IEP			.949 (.197)	.800	.965 (.198)	.863
Age (in months)			.999 (.016)	.931	.998 (.016)	.917
Child talk to teachers			1.115 (.013)	.000	1.116 (.013)	.000
Level 2 Fixed effect:						
Instructional support					1.136 (.134)	.280
Variance estimate of random effect:						
Classroom	.123 (.090)		.157 (.073)		.143 (.068)	
Wald χ^2	2.35	.504	86.89	.000	90.28	.000
df	6		10		11	
AIC	503.96		453.35		454.22	
BIC	520.53		480.97		484.61	

Note. The outcome variable is the number of cycles in which any teacher repeated or confirmed the focal child's language. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 117$; classrooms, $n = 21$.

In Model 1, none of the predictors were statistically significant, nor was the overall model. When gender, IEP, age, and the frequency of child talk were added in Model 2, focal children's inhibitory control emerged as a significant predictor of how often teachers repeated children's language. Teachers more often repeated the language of children with high inhibitory control. The frequency of child talk to teachers was also a significant predictor, which was expected, given that child talk must occur in order for teachers to repeat it. The more a child talked to teachers, the more teachers repeated his/her language. Model 2 fit the data substantially better than Model 1, with lower AIC and BIC and an overall significant Wald χ^2 test.

Adding classroom quality in Model 3 changed the coefficients only slightly, and there was not a significant association between classroom quality and the frequency of teachers repeating language. In this final model, there was a significant effect of children's inhibitory control, such that—holding constant classroom quality, the frequency of the child's talk to teachers, and the child's shyness, English proficiency, gender, IEP status, and age—for every one-point increase in inhibitory control, there was a 57.8% increase in the rate of teachers repeating the child's language. Not surprisingly, there was also a significant effect of child talk; for every additional cycle that the focal child spoke to teachers, there was an 11.6% increase in the rate of teachers repeating the child's language, holding constant all other variables in the model.

Teacher elaborates on child language. Next, I examined how often teachers elaborated on the child's speech. Teachers' elaborations are important for children's language development, because they provide contingent responses that help children learn how to communicate their meaning, they often encourage further back-and-forth interaction, and they can model more sophisticated syntactic structures and vocabulary. There were several significant predictors of the frequency of teachers' elaborations, as shown in Table 25.

Table 25

Results of Multilevel Negative Binomial Models Predicting Teacher Elaboration

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.855 (.104)	.197	.995 (.079)	.948	.978 (.076)	.772
Inhibitory control	.791 (.125)	.137	1.400 (.174)	.007	1.449 (.178)	.002
English proficiency	1.003 (.006)	.634	.997 (.004)	.559	.998 (.004)	.701
Gender – Female			.578 (.087)	.000	.556 (.082)	.000
IEP			.759 (.169)	.214	.800 (.170)	.293
Age (in months)			.969 (.016)	.057	.968 (.015)	.039
Child talk to teachers			1.163 (.016)	.000	1.164 (.016)	.000

Level 2 Fixed effect:						
Instructional support					1.291 (.108)	.002
Variance estimate of random effect:						
Classroom	.000 (.000)		.074 (.051)		.028 (.035)	
Wald χ^2	4.75	.191	135.30	.000	149.97	.000
df	5		10		11	
AIC	567.45		489.24		483.41	
BIC	581.26		516.86		513.79	

Note. The outcome variable is the number of cycles in which any teacher elaborated upon the focal child's language. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 117$; classrooms, $n = 21$.

There were no significant predictors in Model 1, and the overall model was not statistically significant. Recall that the Level-2 variance estimate for elaboration was nearly zero, which may be biased by the small cluster size ($n = 3$ to $n = 6$). As a result, this model is not accounting for any Level-2 variance, so the estimates may be imprecise and should be interpreted with caution. With the addition of gender, IEP status, age, and child talk in Model 2, the Level-2 variance was estimated (.074) and several significant predictors emerged. Accounting for the level-1 covariates allowed for a more precise variance estimate of the random effect, and it suggested that there was between-classroom variation in teachers' use of elaboration. Children's inhibitory control, gender, and frequency of talk to teachers all significantly predicted how much their teachers elaborated on their speech. The overall model was statistically significant, and the AIC and BIC were substantially lower than in Model 1. It is worth pointing out the drastic change to the coefficient for inhibitory control when the level-1 covariates were added. Some of this may be related to the previously described instability in Model 1, but it likely also occurred because gender and age were significantly correlated with inhibitory control. Once they were both accounted for in Model 2, the effect of inhibitory control switched from being negative to positive.

The addition of classroom quality in Model 3 further improved the model fit. In this final model, classroom quality as well as children's inhibitory control, gender, age, and frequency of talk to teachers were all significant predictors. With every one-point increase in inhibitory control, there was a 44.9% increase in the rate of teacher elaboration, holding constant classroom quality and child shyness, English proficiency, gender, IEP status, age, and frequency of talk to teachers. Teachers elaborated on girls' speech at a rate 44.4% lower than that of boys, holding constant all other variables in the model. With every one-month increase in a child's age, there was a 3.2% decrease in their teachers' rate of elaboration on their speech, holding all other variables constant. For every additional cycle that children spoke to teachers, there was a 16.4% increase in the rate of teacher elaboration, holding constant all other variables. Finally, for every one-point increase in classroom quality, there was a 29.1% increase in the rate of teacher elaboration, holding constant child shyness, inhibitory control, English proficiency, gender, IEP status, age, and frequency of talk to teachers.

Interaction effects. Because gender was such a strong predictor of teacher elaborations, I conducted additional analyses to see if there was an interaction with any of the predictors of interest (i.e., shyness, inhibitory control, or English proficiency). There was a significant interaction between gender and English proficiency indicating that gender moderated the effect of group-mean-centered ELP on the frequency of teachers' elaborations, as shown in Table 26.

Table 26

Results of Model with Interaction Effect of Gender and ELP on Teacher Elaboration

	IRR (SE)	*p*
Level 1 Fixed effects:		
Shyness	.966 (.074)	.648
Inhibitory control	1.480 (.179)	.001
English proficiency	1.006 (.005)	.278
Gender – Female	.574 (.083)	.000
IEP	.827 (.173)	.363

Age	.960 (.015)	.011
Child talk to teacher	1.170 (.016)	.000
Gender x ELP	.980 (.008)	.017
Level 2 Fixed effect:		
Instructional support	1.328 (.109)	.001
Variance estimate of random effect:		
Classroom	.025 (.033)	

Note. The outcome variable is the number of cycles in which a teacher elaborated on the child's talk. Incidence rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. Students, $n = 117$; classrooms, $n = 21$.

Simple slopes estimates revealed that teachers elaborated significantly less for girls with higher ELP than for girls with lower ELP ($p = .032$), whereas there was not a significant effect of ELP for boys ($p = .278$), as shown in Figure 22. For every ten-point increase in girls' ELP, there was a 14.3% decrease in the rate of teachers elaborating on their speech.

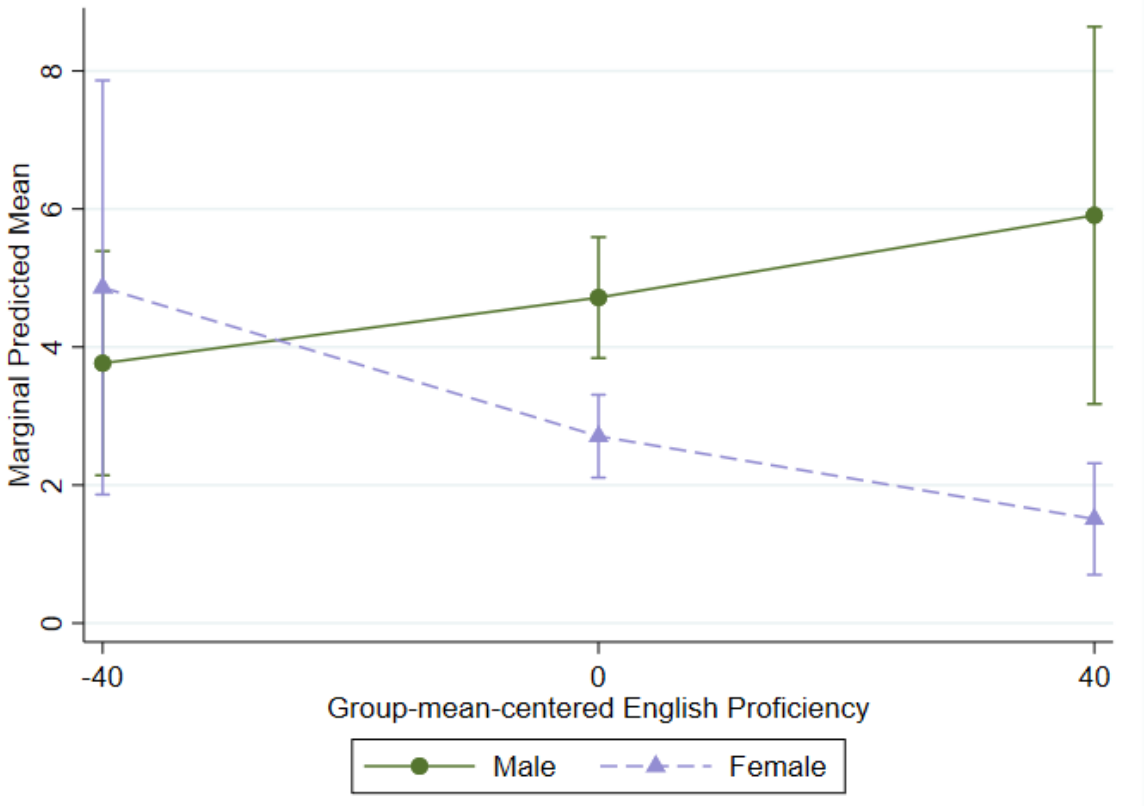

Figure 22. Interaction between children's gender and ELP for teacher elaboration

Teacher gives directions. None of the three overall models predicting teachers giving directions were statistically significant, as seen in Table 27. In addition, none of the predictors were significantly related to how often teachers gave directions to children. The variance estimate of the random effect was close to zero for all three models, which indicates that these findings should be interpreted with caution.

Table 27

Results of Multilevel Negative Binomial Models Predicting Teachers Giving Directions

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.913 (.048)	.084	.905 (.050)	.069	.906 (.050)	.070
Inhibitory control	.933 (.069)	.347	.919 (.079)	.326	.918 (.078)	.317
English proficiency	1.000 (.003)	.982	1.000 (.003)	.971	1.000 (.003)	.965
Gender – Female			1.007 (.094)	.945	1.013 (.095)	.893
IEP			1.103 (.139)	.437	1.102 (.139)	.440
Age (in months)			1.004 (.011)	.710	1.004 (.011)	.707
Child talk to teachers			.996 (.009)	.620	.996 (.009)	.602
Level 2 Fixed effect:						
Instructional support					.972 (.048)	.562
Variance estimate of random effect:						
Classroom	.000 (.000)		.000 (.000)		.000 (.000)	
Wald χ^2	4.96	.175	6.01	.539	6.36	.607
df	5		9		10	
AIC	677.87		684.87		686.54	
BIC	691.68		709.73		714.16	

Note. The outcome variable is the number of cycles in which any teacher gave the child directions. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 117$; classrooms, $n = 21$.

Teacher requests language. Table 28 displays the results of modeling teachers' requests for child language, which most often involved asking the focal child a question.

Table 28

Results of Multilevel Negative Binomial Models Predicting Teachers Requesting Language

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.944 (.051)	.292	1.016 (.047)	.730	1.015 (.047)	.741
Inhibitory control	.992 (.074)	.918	1.116 (.078)	.115	1.119 (.078)	.108
English proficiency	.998 (.003)	.427	.996 (.002)	.057	.996 (.002)	.058
Gender – Female			.926 (.075)	.343	.921 (.075)	.312
IEP			1.037 (.123)	.759	1.039 (.123)	.750
Age (in months)			1.010 (.009)	.260	1.010 (.009)	.262
Child talk to teachers			1.043 (.007)	.000	1.043 (.007)	.000
Level 2 Fixed effect:						
Instructional support					1.107 (.107)	.295
Variance estimate of random effect:						
Classroom	.125 (.053)		.131 (.051)		.122 (.048)	
Wald χ^2	1.77	.620	44.76	.000	45.69	.000
df	6		10		11	
AIC	679.87		654.81		655.75	
BIC	696.45		682.43		686.13	

Note. The outcome variable is the number of cycles in which any teacher requested language from the focal child. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 117$; classrooms, $n = 21$.

Across all three models, the only significant predictor was the frequency of children's talk to teachers (in Models 2 and 3). For every additional cycle that a child spoke to his/her teachers, there was a 4.3% increase in the rate of teacher requests for child language, holding all other variables in the model constant. This relationship is likely bidirectional; teachers' requests for language may have encouraged children to talk to their teachers, and children's talk to their teachers may have led the teachers to ask follow-up questions, thereby requesting further language from children.

Teacher provides contextualized language. Next, I modeled teachers' use of contextualized language, as shown in Table 29. This includes providing information and labeling items, and it can be particularly useful for children's vocabulary development.

Table 29

Results of Multilevel Negative Binomial Models Predicting Teachers Providing Contextualized Language

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.896 (.056)	.082	.966 (.056)	.550	.966 (.056)	.548
Inhibitory control	1.095 (.093)	.286	1.136 (.100)	.147	1.140 (.100)	.137
English proficiency	.994 (.003)	.036	.991 (.003)	.002	.991 (.003)	.002
Gender – Female			1.057 (.110)	.595	1.050 (.109)	.639
IEP			.915 (.134)	.544	.917 (.134)	.553
Age (in months)			1.014 (.011)	.214	1.014 (.011)	.218
Child talk to teachers			1.038 (.009)	.000	1.039 (.009)	.000
Level 2 Fixed effect:						
Instructional support					1.109 (.039)	.385
Variance estimate of random effect:						
Classroom	.187 (.077)		.190 (.075)		.183 (.072)	
Wald χ^2	6.38	.095	28.37	.000	29.19	.000
df	6		10		11	
AIC	714.12		703.87		705.13	
BIC	730.69		731.49		735.51	

Note. The outcome variable is the number of cycles in which any teacher provided the focal child with contextualized language. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 117$; classrooms, $n = 21$.

In Model 1, children's English proficiency was a significant predictor of how much teachers used contextualized language to provide the child with information. The higher a child's English proficiency, the less contextualized language his/her teachers used. English proficiency remained a significant predictor in Models 2 and 3, when gender, IEP status, age, frequency of child talk to teachers, and classroom quality were added. Child talk to teachers was also a

significant predictor of teachers providing contextualized information. In the final model, for every ten-point increase in children's English proficiency, there was an 8.7% decrease in the rate that teachers provided the child with information using contextualized language, holding constant classroom quality as well as child shyness, inhibitory control, gender, IEP status, age, and frequency of talk to teachers. For every additional cycle that children spoke to teachers, there was a 3.9% increase in the rate of teachers using contextualized language, holding all other variables constant. This association again suggests a possible bidirectional relationship between child and teacher language. For example, as children speak more to their teachers, their teachers provide them with more contextualized information—labeling objects, describing the child's actions, and so on. As teachers use contextualized language more often, they may provide children with vocabulary that supports children's responses.

Teacher uses or requests decontextualized language. In contrast to contextualized language, decontextualized language is more abstract and occurs less frequently. Because of its rarity, the LISn instrument combines teachers' use of decontextualized language and their requests for children to use decontextualized language into one category. Even so, it occurred in 3.6 percent of cycles, on average—far lower than teachers' use of or requests for contextualized language (15.3% and 14.5%, respectively). None of the predictors were associated with teachers' use of or requests for decontextualized language, as shown in Table 30.

Table 30

Results of Multilevel Negative Binomial Models Predicting Teachers' Decontextualized Language

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	1.244 (.228)	.233	1.274 (.243)	.203	1.276 (.243)	.200
Inhibitory control	.943 (.225)	.804	1.007 (.261)	.977	1.007 (.261)	.979
English proficiency	1.003 (.008)	.665	1.002 (.008)	.812	1.002 (.008)	.820
Gender – Female			.802 (.225)	.433	.809 (.228)	.452
IEP			1.070 (.423)	.865	1.067 (.422)	.869
Age (in months)			1.021 (.032)	.509	1.021 (.032)	.507
Child talk to teachers			1.007 (.027)	.781	1.008 (.027)	.758
Level 2 Fixed effect:						
Instructional support					.929 (.198)	.732
Variance estimate of random effect:						
Classroom	.435 (.259)		.407 (.250)		.402 (.249)	
Wald χ^2	1.51	.680	2.80	.903	2.91	.940
df	6		10		11	
AIC	459.38		466.09		467.98	
BIC	475.96		493.72		498.36	

Note. The outcome variable is the number of cycles in which any teacher used decontextualized language or requested it from the focal child. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 117$; classrooms, $n = 21$.

Teacher reads to focal child. For the final category of teacher talk, I modeled the frequency of teachers reading to focal children, as shown in Table 31. In Model 1, none of the predictors was significantly associated with teachers reading to children. In Model 2, the frequency of children's talk to teachers was significantly associated with an increase in teachers reading. In the final model, both children's talk to teachers and classroom quality were significant predictors of the frequency of teachers reading to focal children. For every additional cycle that children spoke to their teachers, there was a 13.3% increase in the rate of teachers reading to them, holding constant classroom quality as well as child shyness, inhibitory control,

English proficiency, gender, IEP status, and age. For every one-point increase in classroom quality, there was a 312% increase in the rate of teachers reading to focal children, holding all other variables in the model constant. There is clearly a strong association between the CLASS Instructional Support domain and the frequency of teachers reading. Three of the four classrooms with the highest classroom quality ratings were also among the four classrooms with the highest median amount of reading. It is important to note that classroom quality ratings were derived from multiple observations on separate days from the LISn observation, and the CLASS does not explicitly reward teachers for reading to children.

Table 31

Results of Multilevel Negative Binomial Models Predicting Teachers Reading

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	1.209 (.397)	.563	1.468 (.516)	.275	1.548 (.563)	.230
Inhibitory control	.518 (.231)	.141	.838 (.419)	.724	.799 (.405)	.658
English proficiency	.980 (.015)	.193	.977 (.016)	.151	.976 (.016)	.138
Gender – Female			.530 (.309)	.275	.554 (.323)	.311
IEP			1.145 (1.121)	.890	.944 (.913)	.953
Age (in months)			.943 (.058)	.336	.939 (.058)	.314
Child talk to teachers			1.125 (.056)	.019	1.133 (.057)	.013
Level 2 Fixed effect:						
Instructional support					3.122 (1.556)	.022
Variance estimate of random effect:						
Classroom	3.401 (2.293)		3.886 (2.447)		2.104 (1.756)	
Wald χ^2	4.35	.226	12.38	.089	15.43	.051
df	6		10		11	
AIC	283.01		282.63		279.99	
BIC	299.58		310.25		310.37	

Note. The outcome variable is the number of cycles in which any teacher reads to the focal child. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 117$; classrooms, $n = 21$.

Teachers' use of English. In the final two models of teacher talk, I examined their use of English and Spanish. The models for teachers' English use are shown in Table 32.

Table 32

Results of Multilevel Negative Binomial Models Predicting Teachers' Use of English

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.932 (.030)	.027	.967 (.028)	.249	.966 (.029)	.245
Inhibitory control	.996 (.047)	.927	1.044 (.049)	.356	1.046 (.049)	.341
English proficiency	.999 (.003)	.557	.998 (.001)	.145	.998 (.001)	.148
Spanish proficiency	1.000 (.001)	.970	1.000 (.001)	.644	1.000 (.001)	.641
Gender – Female			.954 (.050)	.372	.951 (.050)	.337
IEP			.946 (.069)	.449	.947 (.069)	.452
Age (in months)			1.005 (.006)	.332	1.005 (.006)	.338
Child talk to teachers			1.021 (.005)	.000	1.021 (.005)	.000
Level 2 Fixed effect:						
Instructional support					1.033 (.044)	.454
Variance estimate of random effect:						
Classroom	.018 (.010)		.019 (.009)		.018 (.009)	
Wald χ^2	5.50	.240	30.76	.000	31.26	.000
Df	7		11		12	
AIC	807.74		794.61		796.06	
BIC	827.08		824.99		829.20	

Note. The outcome variable is the number of cycles in which any teacher speaks to the focal child in English (any category of teacher talk). Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 117$; classrooms, $n = 21$.

The models for teachers' use of English were similar to the models of overall teacher talk (Table 23), because most teacher talk occurred in English. As with overall talk, child shyness was a significant predictor of teachers' English use in Model 1, but once the level-1 covariates were added in Model 2, there was no longer an effect of child shyness. In the final model, child talk to teachers was the only significant predictor of the frequency of teacher talk in English. For every additional cycle that the focal child spoke to his/her teachers (in any language), there was a

2.1% increase in the rate of teacher talk in English, holding constant child shyness, inhibitory control, English and Spanish proficiency, gender, IEP status, age, and classroom quality.

Teachers' use of Spanish. Finally, as shown in Table 33, I modeled teachers' use of Spanish with the Spanish-speaking focal children (n = 87).

Table 33

Results of Multilevel Negative Binomial Models Predicting Teachers' Use of Spanish

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	1.044 (.153)	.769	1.008 (.152)	.958	1.005 (.152)	.973
Inhibitory control	.797 (.183)	.322	.854 (.215)	.530	.853 (.215)	.527
English proficiency	.991 (.008)	.242	.994 (.008)	.467	.994 (.008)	.463
Spanish proficiency	1.019 (.007)	.007	1.017 (.007)	.013	1.017 (.007)	.013
Gender – Female			1.088 (.290)	.751	1.081 (.290)	.771
IEP			1.612 (.522)	.141	1.616 (.525)	.139
Age (in months)			.951 (.026)	.066	.951 (.026)	.066
Child talk to teachers			1.002 (.023)	.925	1.002 (.023)	.931
Level 2 Fixed effect:						
Instructional support					1.039 (.239)	.868
Variance estimate of random effect:						
Classroom	.456 (.254)		.458 (.245)		.452 (.245)	
Wald χ^2	8.56	.073	13.86	.085	13.89	.126
Df	7		11		12	
AIC	326.22		328.83		330.81	
BIC	343.48		355.96		360.40	

Note. The outcome variable is the number of cycles in which any teacher speaks to the focal child in Spanish (any category of teacher talk). Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, n = 87; classrooms, n = 21.

Across all three models, children's Spanish language proficiency was the only significant predictor of teachers' Spanish use. In the final model, for every ten-point increase in children's Spanish proficiency, there was an 18.4% increase in the rate of teachers' Spanish language use, holding constant children's shyness, inhibitory control, English proficiency, gender, IEP status,

age, frequency of talk to teachers, and classroom quality. This result should be interpreted with caution, however, because the models were not significantly different from a null model, and model fit worsened with the addition of more predictors in Models 2 and 3. It is likely that the sample was too small to estimate this many parameters ($df = 12$), especially for a teacher-talk outcome variable that occurred so rarely.

CHAPTER 5

Discussion and Conclusion

This is the first study to examine the relationship between children's temperaments and their preschool classroom language experiences. By investigating bidirectional relationships between child and classroom characteristics in a naturalistic classroom setting, this study draws attention to the importance of studying how classroom processes may vary for individual children. The results of this study are a valuable addition to the growing literature on children's unique experiences in the classroom. This study suggests that the frequency of children's talk in the preschool classroom depends in part on their characteristics, including shyness and gender. In addition, teachers use different types of language to varying degrees depending on children's characteristics, including English proficiency and inhibitory control. Considering the important role that children's early language use and exposure play in their development, these findings suggest that continued investigation of children's unique classroom experiences is warranted.

Patterns of Classroom Talk

Overall frequencies and patterns of talk were consistent with previous studies that used the LISn to examine teacher and child language use. For example, the most common types of teacher talk were giving directions, providing information using contextualized language, and requesting contextualized language from children (Atkins-Burnett et al., 2011; Sawyer et al., 2018). Teachers spoke more often in the classroom than children did. Very little classroom talk occurred in Spanish, even though the majority of children and teachers were bilingual (Atkins-Burnett et al., 2011; Franco et al., 2019; Sawyer et al., 2018).

Children talked more to their peers than to their teachers, as previous studies have found (Franco et al., 2019; Sawyer et al., 2018). Considering there were many more children to talk to

in the classroom than teachers, this was expected. Given that children spend more time in the classroom speaking to their peers than to their teachers, professional development efforts should help teachers encourage and scaffold these peer interactions to ensure that children support one another's language development. Classroom composition may also play an important role; there is evidence that children benefit from having classmates with a range of language proficiencies (Atkins-Burnett, Xue, & Aikens, 2017; Mashburn et al., 2009).

There were differences between classrooms in how much children talked to both peers and teachers. Previous research has demonstrated that children's language learning opportunities in preschool vary depending on how their teachers structure the activities of the day (Fuligni, Howes, Huang, Hong, & Lara-Cinisomo, 2012). It is possible that some classrooms in the current study provided more opportunities for children to interact with their peers, perhaps in child-directed free play or recess; others may have involved more teacher-directed whole-group or small-group activities. Fuligni and colleagues (2012) found that children in classrooms with relatively equal time spent in child- and teacher-directed activities had better language outcomes than children who spent a greater proportion of the day interacting with their peers. There are, however, benefits to spending time with peers in child-directed activities, including gross motor development and engagement in imaginative play.

In the current study, children's interactions with peers—particularly their engagement in sustained conversations—were often occasions for socio-emotional learning. Sustained conversations tended to occur in response to conflict, as children navigated the challenges of shared materials and space, different perspectives, and the resulting frustrations and disagreements. Consider the following example, in which three children experienced and resolved a conflict without teacher involvement. During center time, Lucy and Aziza sat at a

table with bins full of multi-colored plastic elephants and large plastic worksheets that encouraged them to create patterns or sort the elephants by color and size. A mound of gray clay sat nearby. The focal child, Adriana, walked over and started folding the clay and prodding it with her index fingers. As Adriana manipulated the clay, she watched Lucy and Aziza play with the elephants and asked what they were doing. She noticed that they were not placing the elephants according to the images printed on the worksheets, so she pointed to one worksheet and said, "That's for small." Lucy and Aziza looked at the worksheet but neither child responded. Adriana looked at the other worksheet and told them how to use it: "The small ones go right here. The big ones go right here." Aziza told her, "No! It doesn't matter," and Lucy chimed in, "Yeah!" while she continued to place the elephants on her worksheet. Adriana pulled a small piece of clay off the mound on the table and wrapped it around her finger as she argued quietly back and forth with Lucy a few times. A classmate cried nearby. Aziza offered Adriana a worksheet of her own, but Adriana continued to manipulate the clay in her hand. Finally, she told Lucy to stop arguing, and the conversation changed topic and came to a close:

> Lucy: <u>You</u> stop. You the boss? No.
>
> Adriana: You are. No. <u>I</u> am. (*Moving over to the worksheet Aziza had laid out for her*) My <u>sister</u> is the boss.
>
> Lucy: <u>My</u> sister is the boss too.
>
> Adriana: My sister-
>
> Aziza: My brother can do anything. He's the boss.
>
> Adriana: (*Pointing to her eye as she approached Aziza*) You remember your brother had a red eye?
>
> Aziza: Yeah.

The three girls continued to work independently and silently on their worksheets until they eventually left the table, one after the other. This interaction lasted longer than many peer interactions observed during the current study, which may have been possible because teachers did not intervene during their minor disagreement. Previous studies have found that when teachers are nearby during a peer conflict, they are likely to separate the children and end the conflict (Roseth et al., 2008). They may have proactively said something to prevent the disagreement from escalating (e.g., "The worksheets can be used in different ways" or "Share the worksheets"). Instead, these three girls maintained a lengthy interaction that provided them with autonomy to negotiate amongst themselves and supported the development of their conflict-resolution skills. Prior research has found that children are more likely to continue interacting with peers after a conflict if there is no teacher present (Laursen & Hartup, 1989). By engaging in back-and-forth interactions with peers, children are also building their communicative skills as they practice turn-taking and use language to negotiate meaning. Teacher intervention can in fact be useful for children's linguistic and socio-emotional development if it involves mediation of the conflict rather than cessation (Myrtil et al., 2019, March). Teachers in the current study would occasionally mediate peer conflicts by telling children to "Use your words," thus assisting in finding a resolution and supporting children's communicative competency.

The Relationship between Child Characteristics and Classroom Talk

There were several significant associations between children's characteristics and how much they and their teachers talked in the classroom. Considering recent findings that children who have more frequent interactions in the preschool classroom have higher expressive language skills at the end of the year (Bratsch-Hines et al., 2019; Franco et al., 2019), it is important that we understand the factors that contribute to the frequency of children's classroom interactions, so

that teachers can provide communicative support for all children. This study specifically examined associations between children's classroom experiences and their shyness, inhibitory control, English and Spanish proficiency, gender, IEP status, and age. Findings for each characteristic are described in this section.

Shyness. Correlations suggested that teachers gave fewer directions to shy children, perhaps because they demanded less attention or were more compliant than their more extroverted peers. Indeed, prior literature suggests that shy children are less likely to speak out of turn (Keogh, 2003), which may be why they are less likely to have conflictual relationships with their teachers (Rudasill, Rimm-Kaufman, Justice, & Pence, 2006).

In classrooms with lower classroom quality, shy children talked less to their teachers than their more extroverted peers did. This is consistent with previous studies, which have found that shy children initiate fewer interactions with their teachers (Rudasill & Rimm-Kaufman, 2009). These patterns of behavior may help to explain why extroversion has been found to protect children against SES-related adversity. In a twin study of the genetic and environmental factors that contribute to children's cognitive development, for example, Kim-Cohen, Moffitt, Caspi, and Taylor (2004) found that five-year-olds with an outgoing temperament had higher cognitive outcomes and were more resilient to SES adversity. These findings do not suggest that shyness is a vulnerability that children must overcome, but rather that outgoing children's resilience most likely stems from their increased interactions with teachers. Teachers can be trained to support the unique communicative needs of the children in their classrooms to ensure that all children have equal opportunities to talk with their teachers.

In fact, in higher-quality classrooms, there was no effect of shyness on children's language use. There are several ways in which high- and low- quality classrooms may have

differed to account for this distinction. First, teachers in higher-quality classrooms may have actively encouraged all children in their classrooms to speak, and in fact, there was a correlation between classroom quality and teacher requests for language. Children talked more to their teachers when teachers requested language from them, regardless of shyness, but this alone cannot explain the difference between high- and low- quality classrooms. In addition, some teachers may have engaged in practices that contributed to both classroom quality ratings and child behavior. For example, they may have created a classroom climate in which all children felt comfortable, supported, and listened-to when they talked. Indeed, teachers in high-quality classrooms elaborated more on children's speech, which may have encouraged shy children to continue interacting with their teachers. They may have provided children with sufficient time to process and respond to teachers' talk at their own pace—a beneficial pause sometimes called *wait time*—which is not often observed in preschool classrooms (Hindman, Wasik, & Bradley, 2019). Finally, it is possible that there were differences in the characteristics of children enrolled in high-quality versus low-quality classrooms that also contributed to their frequency of talk but were not accounted for in the analyses. Taken together, these findings suggest that teachers can provide all children in their classrooms with equal opportunities to speak, and children—shy or not—will take advantage of these opportunities.

Inhibitory control. Children with higher inhibitory control talked less to their teachers than children with lower inhibitory control. Their regulatory skills may have helped them control the urge to speak at inappropriate moments throughout the day, such as when gathered during whole group or after being told to use their "listening ears." Despite talking to their teachers less often, children with higher inhibitory control experienced more teacher responses than their less-inhibited peers. Higher inhibitory control was associated with teachers repeating child language

and elaborating on it more frequently, after controlling for other characteristics. This may give children with high inhibitory control an important advantage. When an adult recasts a child's speech, the child has an opportunity to reflect on the meaning and accuracy of his or her words, which supports language development, especially for DLLs (Nicholas, Lightbown, & Spada, 2001).

Further research is warranted regarding the associations between children's inhibitory control and teacher elaborations on their language. When only shyness and English proficiency were being controlled for, there was not a significant relationship between inhibitory control and teacher elaboration, and it trended toward negative (i.e., teachers elaborated less on the language of children with higher inhibitory control). With the addition of gender and the frequency of child talk to teachers, however, children's inhibitory control positively predicted their exposure to teacher elaboration. Considering the important role that contingent adult responses play in children's language development, the higher-quality teacher interactions experienced by children with high inhibitory control may help explain the positive relationship between children's self-regulatory skills and their language outcomes (Maier et al., 2012; McClelland et al., 2007). It is also worth noting that once children enter kindergarten, the expectations for their inhibitory control increase; they must sit still and remain quiet for a larger proportion of the day, so children who are able to regulate their behavior and meet these expectations may continue to benefit from richer teacher-child interactions than their peers.

However, this finding may be partially due to multicollinearity between inhibitory control and gender. Boys had lower inhibitory control than girls, and teachers elaborated on boys' talk almost twice as much as they did on girls' talk. The complex associations between inhibitory control and teacher elaboration are likely also related to the nature of teacher elaboration, which

could either be linguistically rich responses to children's language or management of children's behavior by elaborating on how they should act (e.g., after a child calls out, a teacher might say, "I hear you. Now is quiet listening time."). The types of elaboration teachers use are likely to vary depending on children's inhibitory control, but this investigation is beyond the scope of the current study.

English language proficiency. With the entire sample, there were more relationships between children's ELP and the frequency of their talk than there were between children's ELP and the frequency of teachers' talk. For example, children with higher English proficiency talked more to their teachers and had more sustained conversations with both teachers and peers, regardless of whether they were speaking English or Spanish. The removal of children with very low English proficiency scores, however, rendered most of these child-talk relationships non-significant. The only one that remained significant was the frequency of children's talk in English; consistent with Sawyer et al.'s (2018) aggregate findings, children with higher English proficiency spoke more in English than their less-proficient peers.

Teachers used contextualized language more often with children who demonstrated lower English proficiency than with children who had higher ELP. This may be evidence that teachers were differentiating instruction, as contextualized language can be a particularly useful tool for supporting children's second-language acquisition. By providing DLL children with concrete language, visual cues, and/or gestures—all of which contextualize language in the here and now––teachers were helping them learn and integrate new vocabulary (Castro et al., 2011).

There was also an effect of ELP on teacher elaboration, but only for girls. Teachers elaborated significantly less for girls with higher ELP than girls with lower ELP. They may have again been differentiating instruction by providing more language support for girls with lower

English skills. During elaboration, teachers could have asked children follow-up questions or restated their language in complete sentences or with more sophisticated vocabulary or added detail, such as prepositions, adjectives, or adverbs. These practices are all useful for DLLs' language development (Castro et al., 2011). It is unclear why the same pattern did not occur for boys. Regardless of ELP, teachers provided boys with equal amounts of elaboration. Perhaps teachers recognized that boys' language skills tend to be lower than girls' at this age, so they provided all boys with more elaboration. If we think of teacher language as a scarce resource in the classroom, teachers may have been strategically elaborating more for the children whom they perceived as needing it most: girls with lower ELP and boys.

Spanish language proficiency. Unsurprisingly, children with higher Spanish proficiency spoke more in Spanish to both teachers and peers; teachers also spoke to these children more often in Spanish than they did to children with lower Spanish proficiency. Teachers often seemed to reflect children's language use, using Spanish in response to children's Spanish utterances and English in response to their English. For example, during free-choice in one classroom, three girls stood in a corner of the classroom pretending to take photos of each other with a wooden toy camera. When the photographer, Cristina, was particularly pleased with her composition (the other two girls standing against the wall, holding each other's shoulders and smiling), she shouted out to her lead teacher across the room: "Mira, teacher! Mira! Mira, teacher!" The teacher could not understand Cristina across the noises of the busy classroom, and asked her to repeat herself: "¿Mande?" Cristina pointed toward her friends and repeated herself, this time in English: "Look!" The teacher responded in English, "Wow, that's a very nice picture." By initially responding to Cristina in Spanish, this teacher made it clear that Spanish is welcome in her classroom, but she switched to using English when Cristina herself switched languages.

Teachers occasionally supported children's Spanish language development explicitly, though this was not observed frequently. During whole group in one classroom, for example, the lead teacher was talking about the days of the week, and one child exclaimed, "I like Saturday, because Saturday is domingo!" The teacher corrected him, saying, "Saturday is sábado. Sunday is domingo," and then asked him why he likes those days, continuing to refer to them in Spanish. The documents on the walls of this classroom provided further evidence that the teachers valued children's Spanish language use. On a large sheet of paper, for example, the children had dictated their responses to the question "What is a road?" Several of the responses included the word *llantas*, which is the Spanish word for *tires* (e.g., "My car has two llantas"). One child's response was entirely in Spanish: me lleva con mi mami que esta trabajando (which approximately translates as "It takes me with my mom who is working"). Nearby hung children's drawings of roads, labeled "Roads/Caminos"; some children's dictated captions of their artwork included Spanish, such as "My road to la escuela" (school).

Other characteristics.

Gender. Girls had more than twice as many sustained conversations with their peers as boys did. It is possible that girls selected activities that were more conducive to peer interaction (Early et al., 2010). Prior literature suggests that preschool girls engage in more social play than boys, and that they tend to play in same-sex groups (Barbu, Cabanes, & Maner-Idrissi, 2011). This is important given that interaction with peers is beneficial for children's language development. Girls' engagement in sustained conversations—most likely with other girls—may provide them with opportunities to build on each other's language skills. Several studies have found that for English-Spanish DLL children in preschool and kindergarten, exposure to more peer talk in English is associated with growth in English expressive language skills (Chesterfield,

Chesterfield, & Chavez, 1982; Palermo et al., 2014; Rojas et al., 2016). If girls engage in extended peer interactions more often than boys, they may have an advantage in terms of their English language development.

IEP status. There were no statistically significant effects of having an IEP on children's or teachers' talk. There was, however, a practically significant effect on the number of sustained conversations children had with their teachers, and this effect was statistically significant once the low-ELP outliers were removed in the sensitivity analysis. Children with IEPs (n = 15) had conversations with their teachers at half the rate of their peers. This may have occurred because of intentional or unintentional teacher practices or biases, or it may have been difficult for these children to engage in the back-and-forth turn-taking that is required for sustained conversations. Previous literature has found that preschool children with specific language impairments are more likely than their peers to respond to a classmate's or teacher's speech by ignoring it (McCabe & Marshall, 2006). Even though the diagnosis for all children with IEPs in the current study was speech or language impairment, their experiences were not homogenous. In one classroom, for example, a child with an IEP had three sustained conversations with his teachers, but his classmates had none. This type of contradiction may have contributed to the lack of significant findings.

It is also possible that the effect of having an IEP on children's sustained conversations with teachers would have been statistically significant with a larger sample size. It is also worth noting that children with IEPs stood apart from their classmates in some boxplots, which suggests that their experiences may be unique within their classrooms, even if the regression analyses did not have the power to capture these differences. For example, the child who heard

the least teacher talk in the whole sample had an IEP, and he was exposed to far less teacher talk than the other children in his classroom.

Age. Younger children spoke more in Spanish than their older peers, even when controlling for English and Spanish proficiency. It is possible that older children had begun to think of English as the language of school and therefore used it in the classroom more often than Spanish. While this study did not address changes in children's language proficiency during preschool, children's frequent exposure to English throughout the school year may have contributed to a decline in their Spanish language development.

Teachers spoke to younger children in Spanish more often than to their older peers, though this did not reach statistical significance. Teachers also elaborated on younger children's language more often than their older classmates. Like the associations with inhibitory control, some of these elaborations may have been behavior management that assisted the younger children with negotiating the demands of the classroom. They also may have been teachers' intentional efforts to provide the youngest children in their classrooms with extra language support.

The Relationship between Classroom Quality and Talk

There were two strengths of high-quality classrooms in addition to the previously described lack of a shyness effect on children's talk to teachers. First, higher-quality classrooms tended to include more teacher elaboration. Teachers in higher-quality classrooms also read to children more frequently. Previous research has shown that teachers ask children more cognitively challenging questions during shared book reading, and the talk that occurs during book reading can support children's vocabulary growth (Dickinson & Porche, 2011; Franco et al., 2019; Hindman et al., 2019; Massey et al., 2008). In the current study, sometimes teachers'

elaboration and reading went hand-in-hand, as teachers responded to children's comments and questions during shared book reading. For example, the following description of a book reading during whole group in one of the high-quality classrooms demonstrates how the lead teacher elaborated on children's language and fostered an environment in which children felt comfortable speaking.

The children were gathered in a semi-circle on the rug as the lead teacher sat on a small chair facing them. She read a book that the class had previously read: *Abiyoyo*, which is based on a South African folktale. Before starting the book, she said, "You guys can help me read it, okay?" which encouraged the children to participate throughout the book reading. On the first page, a character plays a ukulele, and the teacher asked the children, "Who knows what a ukulele is?" Several children shouted, "A guitar!" in response. "A guitar," she confirmed, "Is it a big guitar?" she asked, stretching her arms wide, elaborating on children's choral responses and asking them to clarify. Some shouted, "No!" and others said, "A little guitar!" The teacher nodded and confirmed their responses, "It's a small guitar." Through her request for language and then her elaboration, the teacher encouraged children to contribute to the book reading, supported their vocabulary development, and validated their responses. She continued asking them questions throughout the story (e.g., "Who did they see?"; "How do you think he was feeling?"). Sometimes she would invite children to participate by gesturing and pausing to let them fill in the end of a sentence; at one point, for example, she reached behind her back and shook a table as she said, "Everything started to…" and the children shouted, "Shake!" She welcomed children to speak up and share their thoughts during the story, and she responded to their questions and comments. The children sat attentively for nearly ten minutes as the teacher read the book—far longer than book reading lasted in any other classroom in the study.

Classroom time spent reading books has been linked to children's vocabulary growth, so this teacher's ability to engage children in reading for so long is a valuable skill (Connor et al., 2006).

The Relationship between Teachers' and Children's Talk

For most models, there were significant associations between the frequency of children's and teachers' talk. When teachers requested language from children, children talked more to their teachers and had more sustained conversations with them. There were associations between the frequency of children's talk to teachers and most teacher-talk outcome variables: overall teacher talk, overall English use, repeating children's language, elaborating on children's language, requesting language from children, providing information using contextualized language, and reading. Many of these are inherently tied to one another (i.e., repeating or elaborating on children's language, requesting language), and all of them are likely bidirectional to some extent. The more children talk to teachers, the more their teachers talk to them, and vice versa.

Limitations

This study examined both child-level and classroom-level differences in children's preschool classroom language use and exposure by selecting several focal children from each of the study classrooms. While this approach enabled twenty-one classrooms to participate in the study despite limited time and resources for data collection, there were several limitations that resulted from the small within-classroom sample size. The models—especially those that included interactions—may have been over-specified given the sample size, so estimates may not be precise. By using the same model-building process across all outcome variables, I retained predictors that had no demonstrated relationship with the outcomes, which may have resulted in models that were overly complex. In an effort to produce parsimonious models and to limit the study's burden on teachers, parents, and children, I did not collect information about several

factors that may have contributed to variance in children's classroom language use and exposure, such as teacher-child relationships, or teachers' own shyness. Though this means the study may have suffered from omitted variable bias, the inclusion of additional predictors with a sample of this size would not have been feasible. Finally, the small within-classroom sample size prevented the examination of between-classroom differences in the magnitude of the relationships between the predictors and outcome variables (i.e., random slopes).

The LISn instrument was valuable for gathering information about children's unique classroom language experiences. It allowed for a more fine-grained investigation of multilingual language use and exposure than any other available research tool. There were several limitations, however, to the depth of analysis that it afforded. For example, the LISn did not provide information about the sequence of teachers' and children's talk. That is, I could not determine whether the teacher or the child initiated an interaction. It would have been interesting to know whether teachers initiated more interactions with certain children and whether this was associated with children's characteristics. Such temporal evidence may have also enabled more interpretation of the complex bidirectional relationships between children's and teachers' talk.

In addition, while the LISn captures teachers' use of specific evidence-based categories of talk, it is primarily focused on frequencies. Children certainly benefit from frequent exposure to certain types of adult language and from opportunities to use language themselves. All language, however, is not equally beneficial. Some teachers may be more efficient with their language use than others—providing clear definitions of new terms, asking children challenging but appropriate questions—in the same number of cycles as other, less effective teachers. A teacher's request for language, for example, was coded the same whether it was an open-ended or yes/no question, and children's responses were coded the same whether they spoke in full

sentences or single words. The LISn could not capture details about the content or quality of teachers' and children's language, including important aspects such as syntactic complexity and lexical diversity. Nonetheless, the data provided by the LISn are valuable, because even studies of mere frequency have found that children—especially DLLs— experience more language growth when they speak and hear more language (Bohman, Bedore, Peña, Mendez-Perez, & Gillam, 2010; Bratsch-Hines et al., 2019). Future research should extend the current study's findings by examining how children's characteristics relate to more nuanced aspects of their classroom language use and exposure. As researchers refine measures of children's classroom language experiences, they should include information about the sequence of teacher and child language (i.e., child- vs. teacher-initiated interaction) and the types of questioning teachers use (e.g., open-ended vs. closed-ended). In addition, while some studies treat teacher elaboration as a high-quality teacher-talk variable (Castro et al., 2017), this study's findings about teacher elaboration and inhibitory control raise questions about the content and quality of teachers' elaborations.

As with any observational study of classroom processes, a classroom's observation period may not have been representative of a typical day. Teachers, for example, may have altered their behavior because they knew they were being observed. This may have occurred in one of several ways. Some teachers may have felt uncomfortable being observed and therefore stayed farther away from the observers as they moved around the classroom, therefore limiting the interactions they had with focal children. Other teachers may have increased their interactions with focal children during the observation period. I tried to minimize teachers' discomfort by explaining to them that the study was focused on documenting children's classroom experiences rather than on evaluating teachers' behaviors. In addition, each

observation occurred after researchers had been in the classroom across several days of consenting, language assessment, and practice observations, so teachers and children had likely become somewhat acclimated to our presence in the classroom.

Finally, this study used parent and teacher reports of children's shyness and inhibitory control rather than direct measurement. As with all report measures, there is a risk of reporter bias, but by averaging ratings from multiple sources, I aimed to reduce this risk. It is also possible, however, that the CBQ was not an appropriate measure of shyness for this sample, because shyness is conceptualized differently across cultures. The children in this study were almost entirely Latinx, and Latinx children tend to display higher levels of shyness according to Euro-American norms and measures (Chen, 2019; Gudiño & Lau, 2010). According to Polo and López (2009), many Latinx cultures emphasize the value of a group orientation, which may cause parents to be more sensitive to their children's shyness in social situations. It is possible that raters from different cultural backgrounds perceive different behaviors as shy, which could make the questions on the CBQ construct-irrelevant. Further investigation is required to understand how cultural differences may be associated with parents' and teachers' rating of Latinx children's behaviors.

Future Directions

Future studies on this topic should include more classrooms and more children per classroom. An increased sample size would enable the investigation of between-classroom differences in the effects of children's characteristics on their language use and exposure. It would also allow for the inclusion of additional predictors (e.g., teacher-child relationships, parent educational attainment, teacher shyness, classroom composition). Researchers should also recruit children purposively with the intention of including a larger sample of children with very

low English proficiency. This would help us understand if the two outliers in the current study are anomalies or if their behavior is typical for children with low English proficiency scores.

In addition to increasing the sample size, future studies should conduct observations for each child across more than one day. While this study's classroom observations covered a longer period of time (2-3 hours) than many previous studies, they should not be assumed to perfectly represent the classroom's language environment. Conducting observations across several days would help ensure reliability and even help understand how children's interactions with their teachers change over time (Meyer, Cash, & Mashburn, 2011). If observations were spread out across the school year (e.g., fall, winter, and spring), we could investigate changes in patterns of language use as children and teachers get to know each other and as children develop. These changes may be particularly salient for children who have little or no exposure to English before entering preschool. Previous studies suggest, for instance, that teachers may use Spanish more frequently in the fall than in the spring (Atkins-Burnett et al., 2011).

Attention should be paid in future studies to differences in children's language use and exposure across various activity settings. Previous studies have found that children talk more to teachers during certain settings, such as whole-group time, and teachers use different types of language depending on the context (Barnes, Grifenhagen, & Dickinson, 2016; Booren, Downer, & Vitiello, 2012; Massey et al., 2008; Ryan, Bailey, & Huang, in press). A question is then raised: Do children's characteristics matter more for their language use or exposure in certain activity settings? For example, children with lower English language proficiency may be less inclined to speak when they are engaged in a whole-group setting, but there may be little effect of ELP during one-on-one or small group interactions. It is important to understand connections between children's characteristics and their language use in particular activity settings so that

teachers can be prepared to support children as they navigate the unique demands of each setting. While I collected data about activity settings, this type of investigation was beyond the scope of the current study. Focal children were not engaged in the same sequence of activities as their classmates, so direct comparison across activity settings would not be precise.

In order to design professional development materials based on this study's findings, we need to involve teachers in their interpretation. Through focus groups, teachers could provide valuable insight into the reasons for variability in children's classroom language experiences. Some of the variability described in this dissertation may be the result of differentiated instruction. Teachers can help identify the ways in which they intentionally adapt their instructional practices and language use based on children's individual needs and strengths. We can then strategize about simultaneously meeting the individual needs of their students and ensuring that all children have equal language learning opportunities.

Conclusions and Implications

As policymakers invest significant resources in expanding children's access to preschool and increasing instructional quality, it is the responsibility of researchers to examine how individual children fare in these programs. However, to date, literature on children's unique experiences in the preschool classroom is sparse. This study describes the variability found in individual children's classroom language use and exposure, and it also identifies child characteristics that are associated with this variability, including shyness, inhibitory control, English proficiency, gender, and IEP status. As the findings of this study demonstrate, measurement on a classroom level may not be sufficient to understand how children experience preschool, and the variability found in this study may have implications for children's development. The findings can also help identify areas of focus for professional development

that would support preschool teachers in enriching the language environment of their classrooms to best meet children's individual needs. Studies of language-specific professional development programs have shown that preschool teachers can learn new strategies for supporting children's language development and then apply these strategies in the classroom (Cabell et al., 2015; Castro et al., 2017; Weiland & Yoshikawa, 2013; Wilson et al., 2013).

First and foremost, teachers should be supported in their efforts to ensure that all children have equitable language learning opportunities in the classroom, regardless of their shyness, inhibitory control, English language proficiency, gender, age, or IEP status. They should provide opportunities for children to talk throughout the day and encourage all children to speak to both teachers and peers. At the same time, it is important to differentiate instruction based on children's individual needs and strengths. Teachers in the current study showed some indication of differentiation already; they used more contextualized language with children who had lower English language proficiency, for example. Teachers should be trained to pay attention to how much individual children are talking in the classroom and provide additional supports to any children who might need them in order to interact more with their teachers or peers. This may include speaking with children in their home languages, as several teachers skillfully did in the current study.

Teachers should also be trained to have the kinds of rich language interactions that we know benefit children's language development. Reading to children—a well-established strategy for supporting their linguistic development—took place in few classrooms in the current study. Professional development programs should encourage teachers to read regularly to children and should teach them approaches such as dialogic reading, in which teachers actively involve children in the shared task of reading and ask them cognitively challenging questions about the

story. To help increase the frequency of teachers' sustained conversations with children, teachers should be trained to request language from children using open-ended questions and to elaborate on children's responses. Elaborations may involve asking the child follow-up questions, providing more detail to build on the child's response, or making connections to related topics or prior experiences. Future research should continue to identify children's characteristics that are associated with their language use and exposure and to investigate strategies to help teachers ensure equitable classroom language opportunities while meeting children's individual needs.

APPENDICES

Appendix A

Home Language Identification

I used several sources of data to determine whether to code a child's home language as English or Spanish for the purposes of sample description. School records, collected at enrollment, provided parent report of "Primary Language," which parents could have interpreted as either their own primary language or their child's. Questions about the home language environment are often challenging for parents to answer (Bailey & Kelly, 2013), and the vague wording ("Primary Language") calls into question the validity of these data. To help verify children's home languages, I asked teachers whether each family should receive an English or Spanish consent form during study recruitment. For 25 of the 117 study children, the teachers' suggestions conflicted with the primary language identified in school records. This, however, was still insufficient evidence to assign children a home language. It is possible that teachers were basing their recommendations on the interactions they had with the children's family members during drop-off and pick-up, which may not be fully representative of a child's home environment (e.g., some children may be picked up from school by a grandparent whom they only see for a short period of time each day). Several months later, during data collection, teachers filled out a brief survey in which they identified the "language the child primarily hears at home" as well as "other languages spoken at home" and who speaks them. Teachers, of course, could not know all the details of families' home language use, but they were able to identify households that spoke both English and Spanish, which the other data sources could not do.

As a final data source, the schools provided me with child assessment data, including DRDP results, after data collection was completed. The English language development (ELD) DRDP measure is meant to be administered only to children with a home language other than English. The administration of this ELD measure is therefore a proxy for home language; children with a home language other than English should have been evaluated, and children in households where only English is spoken should not have been evaluated. Presumably school records about a child's home language should have corresponded with ELD administration, but there were numerous inconsistencies. Most notably, two children whose primary language was listed as Spanish were not administered the ELD assessment, suggesting that the school records were incorrect. Twenty children were assessed for ELD even though English was listed as their primary language; some of their scores on the Spanish *pre*LAS were relatively high, so these children likely speak Spanish at home (possibly in addition to English).

Using all four data sources, I investigated which children could be clearly identified as living in English-only/English-dominant households, which were in Spanish-only/Spanish-dominant households, and which were more difficult to assign. Through this process, I created two variables: one that identified the child's primary home language (i.e., English or Spanish) and one that designated if the child was a dual language learner (DLL) or English only learner (EOL), based on whether they had exposure to Spanish in the home (i.e., yes or no).

For 25 children, school records, teachers' consent language recommendations, and assessment data consistently indicated that the child's primary home language was English. In their surveys, however, teachers reported that nine of these children were also exposed to Spanish in the home. According to teachers, three of them live in relatively equal bilingual households, where all family members speak both languages and neither language has

dominance. Six of them live in English-dominant households where one or two family members speak Spanish (e.g., one parent, both grandparents). For the purposes of analysis, I assigned English as the primary home language for all 25 children in this group, and the nine who also hear Spanish at home were considered DLLs.

Spanish was the primary home language for another 57 children, according to school records, consent language, and assessment data. Teacher surveys indicated that English was also spoken in the homes of 39 of these children. In some cases, multiple family members, including parents, spoke both Spanish and English. In others, older siblings were identified as the only English speakers in the household (n = 16). Older siblings can have an impact on preschoolers' language use and can be important resources for their second-language learning (Kibler, Palacios, & Baird, 2014). All 57 children in this group were considered DLLs for the purposes of the current study, and their primary home language was identified as Spanish.

It was more challenging to identify the home language of the remaining 35 children, given the data available. For fourteen children, for example, teachers identified a different primary home language than the school records. I looked for agreement across three of the four indicators. That helped classify 32 children as living in either English-dominant (n = 17) or Spanish-dominant (n = 15) households. The remaining three children had two indicators identifying their primary home language as Spanish and two identifying it as English. In these cases, I looked to children's own proficiency, based on the *pre*LAS, to make the final determination. All three children scored higher on the Spanish *pre*LAS than the English, so I classified their primary home language as Spanish.

In summary, 16 children live in English-only households, 26 in English-dominant, 57 in Spanish-dominant, and 18 in Spanish-only households. Some of the children from English-

dominant households were not assessed using the Spanish *pre*LAS, because language background information that was available at the beginning of the study suggested they were only exposed to English in the home. Of the 117 children in the sample, I consider 101 children to be DLLs learning both Spanish and English and 16 of them to be English-only learners.

The discrepancies described in this appendix highlight the complexity of categorizing children's language backgrounds and the importance of gathering direct assessment data of their language proficiencies. Studies that rely on teacher report or school record data may have incomplete or inaccurate information about children's linguistic experiences and strengths.

Appendix B

LANGUAGE INTERACTION SNAPSHOT (LISn)

CHILD ID: |___|___|___|___|___|___|___|___|___| ENTER THE SNAPSHOT NUMBER FOR THIS CHILD |___|___|

CODING PERIOD: START: |___|___|:|___|___| AM/PM END: |___|___|:|___|___| AM/PM

First 4 letters of Focus Child First Name: |___|___|___|___| First 4 letters of Focus Child Last Name: |___|___|___|___| Clothing Identifier: _____

Code E= English; O= Other language; M=multiple languages in one utterance	**1**	**2**	**3**	**4**	**5**
A. FOCUS CHILD TALKS TO					
a. To Lead Teacher	E O M	E O M	E O M	E O M	E O M
b. To Other Adult	E O M	E O M	E O M	E O M	E O M
c. Other Children/Group	E O M	E O M	E O M	E O M	E O M
B. LEAD TEACHER VERBAL COMMUNICATION DIRECTED TO FC/FC WITH GROUP					
a. Repeats or confirms	E O M	E O M	E O M	E O M	E O M
b. Elaborates or builds (also code one of four below)	E O M	E O M	E O M	E O M	E O M
c. Gives directions	E O M	E O M	E O M	E O M	E O M
d. Requests language (contextualized)	E O M	E O M	E O M	E O M	E O M
e. Provides information, names, labels (contextualized)	E O M	E O M	E O M	E O M	E O M
f. Provides/elicits information (decontextualized)	E O M	E O M	E O M	E O M	E O M
g. Reads	E O M	E O M	E O M	E O M	E O M
h. Sings	E O M	E O M	E O M	E O M	E O M
i. Other Talk	E O M	E O M	E O M	E O M	E O M
C. OTHER ADULT VERBAL COMMUNICATION DIRECTED TO FC/FC WITH GROUP					
a. Repeats or confirms	E O M	E O M	E O M	E O M	E O M
b. Elaborates or builds (also code one of four below)	E O M	E O M	E O M	E O M	E O M
c. Gives directions	E O M	E O M	E O M	E O M	E O M
d. Requests language (contextualized)	E O M	E O M	E O M	E O M	E O M
e. Provides information, names, labels (contextualized)	E O M	E O M	E O M	E O M	E O M
f. Provides/elicits information (decontextualized)	E O M	E O M	E O M	E O M	E O M
g. Reads	E O M	E O M	E O M	E O M	E O M
h. Sings	E O M	E O M	E O M	E O M	E O M
i. Other Talk	E O M	E O M	E O M	E O M	E O M

NOTES:

Code E= English; O= Other language; M=multiple languages in one utterance	6	7	8	9	10
A. FOCUS CHILD TALKS TO					
a. To Lead Teacher	E O M	E O M	E O M	E O M	E O M
b. To Other Adult	E O M	E O M	E O M	E O M	E O M
c. Other Children/Group	E O M	E O M	E O M	E O M	E O M
B. LEAD TEACHER VERBAL COMMUNICATION DIRECTED TO FC/FC WITH GROUP					
a. Repeats or confirms	E O M	E O M	E O M	E O M	E O M
b. Elaborates or builds (also code one of four below)	E O M	E O M	E O M	E O M	E O M
c. Gives directions	E O M	E O M	E O M	E O M	E O M
d. Requests language (contextualized)	E O M	E O M	E O M	E O M	E O M
e. Provides information, names, labels (contextualized)	E O M	E O M	E O M	E O M	E O M
f. Provides/elicits information (decontextualized)	E O M	E O M	E O M	E O M	E O M
g. Reads	E O M	E O M	E O M	E O M	E O M
h. Sings	E O M	E O M	E O M	E O M	E O M
i. Other Talk	E O M	E O M	E O M	E O M	E O M
C. OTHER ADULT VERBAL COMMUNICATION DIRECTED TO FC/FC WITH GROUP					
a. Repeats or confirms	E O M	E O M	E O M	E O M	E O M
b. Elaborates or builds (also code one of four below)	E O M	E O M	E O M	E O M	E O M
c. Gives directions	E O M	E O M	E O M	E O M	E O M
d. Requests language (contextualized)	E O M	E O M	E O M	E O M	E O M
e. Provides information, names, labels (contextualized)	E O M	E O M	E O M	E O M	E O M
f. Provides/elicits information (decontextualized)	E O M	E O M	E O M	E O M	E O M
g. Reads to/with	E O M	E O M	E O M	E O M	E O M
h. Sings to/with	E O M	E O M	E O M	E O M	E O M
i. Other Talk	E O M	E O M	E O M	E O M	E O M

NOTES:

SNAPSHOT CONTEXT – CODE FOR THE 5 MINUTE OBSERVATION

A. CLASSROOM CONTENT
(CODE ALL ACTIVITIES IN WHICH FOCUS CHILD WAS INVOLVED)

ACTIVITY ONE	
1. ☐ Writing/Copying	6. ☐ Singing
2. ☐ Sounds	7. ☐ Aesthetics
3. ☐ Non Print	8. ☐ Science/Nature
4. ☐ Print Related	9. ☐ Social Studies
	10. ☐ Fine Motor
5. ☐ Math, Colors Numbers	11. ☐ Gross Motor
	12. ☐ Other (SPECIFY) _____
	_____

ACTIVITY TWO	
1. ☐ Writing/Copying	6. ☐ Singing
2. ☐ Sounds	7. ☐ Aesthetics
3. ☐ Non Print	8. ☐ Science/Nature
4. ☐ Print Related	9. ☐ Social Studies
	10. ☐ Fine Motor
5. ☐ Math, Colors Numbers	11. ☐ Gross Motor
	12. ☐ Other (SPECIFY) _____
	_____

B. CLASSROOM ACTIVITY STRUCTURE
(CODE ALL TYPES OF GROUPINGS AND TYPES OF ACTIVITIES IN WHICH FOCUS CHILD WAS INVOLVED)

1. ☐ Whole Group Activity	4. ☐ Free Choice/Centers
2. ☐ Small Group Activity	5. ☐ Routine
3. ☐ Individual Time	6. ☐ Meals/Snacks
	7. ☐ Recess/Outside

C. FOCUS CHILD ENGAGEMENT

How much of the 5 minutes . .

		None of the Time	Some of the Time	Half of the Time	Most of the Time	All of the Time
C1.	Was focus child engaged with materials and activities?	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
C2.	Was the teacher's attention directed specifically to the focus child?	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
C3.	Was the focus child in a group with English speakers?	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

D. SUSTAINED CONVERSATIONS

How many times did the focus child participate in sustained conversations . .

		None	Once	More than Once
D1.	With lead teacher?	1 ☐	2 ☐	3 ☐
D2.	With other adult?	1 ☐	2 ☐	3 ☐
D3.	With other children?	1 ☐	2 ☐	3 ☐

Appendix C

Lead vs. Assistant Teacher Talk

Frequency of Child, Lead, and Assistant Teacher Talk

All classrooms had two assistant teachers and only one lead teacher in the classroom at any given time, so what was coded as assistant teacher talk was the talk of two teachers, and child talk to either assistant teacher was coded under one category. This makes comparison across lead and assistant teachers difficult. As described in Chapter 3, I found that children spoke more to their assistant teachers than they did to the lead teacher, $t(116) = 3.73$, $p < .001$. If we instead divide children's talk to assistant teachers (5.74 cycles) by two, as a rough approximation of how much they spoke to each assistant teacher, it appears that focal children spoke slightly more to their lead teachers (i.e., in 3.60 cycles) than they did to assistant teachers (2.87 cycles), though this difference is not statistically significant, $t(116) = -1.73$, $p = .087$.

Table C1 displays the mean, minimum, and maximum number and percentage of cycles that focal children were exposed to each category of teacher talk from their lead teacher or assistant teachers (both assistants combined). For example, in 1.95% of the 60 cycles, on average, the lead teacher repeated what the focal child said, and lead teachers repeated focal children's language in anywhere from 0-17% of the cycles, across all children. There was no significant difference in how much assistant and lead teachers spoke to focal children overall, $t(116) = -0.77$, $p = .443$ (see *Any talk* category in Table C1). Dividing assistant teachers' talk by two, however, revealed that lead teachers spoke to children in significantly more cycles ($M = 12.97$) than assistant teachers did ($M = 6.99$), $t(116) = 5.94$, $p < .001$. This is consistent with prior literature that suggests lead teachers talk more in the classroom than assistant teachers (Sawyer et al., 2018).

Table C1

Frequency and Percentage of Cycles with Categories of Teacher Talk to Focal Children, by Teacher Type

Category of Talk	Lead Teacher				Assistant Teachers (combined)			
	Mean Number of Cycles (SD)	Min – Max Number	Mean Percent of Cycles (SD)	Min – Max Percent	Mean Number of Cycles (SD)	Min – Max Number	Mean Percent of Cycles (SD)	Min – Max Percent
Repeats	1.16 (1.83)	0 – 10	1.95 (3.07)	0 – 17	1.53 (2.02)	0 – 9	2.54 (3.37)	0 – 15
Elaborates	1.44 (2.33)	0 – 12	2.4 (3.9)	0 – 20	2.15 (2.85)	0 – 12	3.58 (4.76)	0 – 20
Gives directions	4.67 (3.76)	0 – 15	7.83 (6.31)	0 – 25	5.19 (3.99)	0 – 17	8.65 (6.66)	0 – 28
Requests language	4.18 (4.22)	0 – 21	6.99 (7.04)	0 – 35	4.58 (3.79)	0 – 16	7.66 (6.33)	0 – 27
Provides information	4.41 (4.31)	0 – 20	7.37 (7.2)	0 – 33	4.91 (4.85)	0 – 27	8.19 (8.1)	0 – 45
Uses/Requests decontext. language	0.86 (1.45)	0 – 7	1.45 (2.44)	0 – 12	1.32 (2.68)	0 – 12	2.23 (4.52)	0 – 20
Reads	0.80 (2.04)	0 – 10	1.32 (3.41)	0 – 17	0.33 (1.45)	0 – 10	0.56 (2.42)	0 – 17
Sings	2.31 (3.35)	0 – 13	3.85 (5.6)	0 – 22	1.55 (2.52)	0 – 12	2.61 (4.24)	0 – 20
Other talk	0.41 (0.77)	0 – 4	0.69 (1.31)	0 – 7	0.52 (0.79)	0 – 3	0.87 (1.33)	0 – 5
English talk, any category	12.58 (8.18)	0 – 34	21.05 (13.66)	0 – 57	13.15 (7.79)	0 – 33	21.99 (12.97)	0 – 55
Spanish talk, any category	0.59 (1.12)	0 – 5	0.99 (1.86)	0 – 8	1.11 (2.04)	0 – 11	1.85 (3.40)	0 – 18
Any talk[a]	12.97 (8.34)	0 – 34	21.70 (13.93)	0 – 57	13.98 (8.16)	0 – 33	23.37 (13.6)	0 – 55

[a] Any talk is the number or percentage of cycles in which the teacher(s) used any category of language with the focal child, in any language.

Relationship between Child and Teacher Talk

Multilevel mixed effects OLS regression models investigated associations between the frequency of assistant/lead teacher talk and the frequency of children's talk to their peers, lead teacher, and assistant teachers. For example, after accounting for between-classroom variance, focal children's talk to both lead and assistant teachers was predictive of how often assistant teachers spoke to the child (see Table C2). The more the child spoke to the assistant teachers, the more they spoke to the child. In contrast, the more a focal child spoke to the lead teacher, the less the assistant teachers spoke to the child.

Table C2

Mixed-Effects Regression of Assistant Teacher Talk to Focal Child

	Coef.	Std. Error	*p*
Fixed Effects:			
Focal child talks to lead teacher	-.50	.24	.037
Focal child talks to assistant teachers	1.69	.17	.000
Focal child talks to another child	-.07	.09	.455
Random Effect:			
Classroom (variance)	55.21	21.09	

Similarly, as shown in Table C3, the number of cycles in which focal children spoke to their lead teachers was significantly predictive of the number of cycles in which lead teachers spoke to children. We cannot, however, predict how much a child will talk to the lead teacher based on how much the child talked to their assistant teachers or peers.

Table C3

Mixed-Effects Regression of Lead Teacher Talk to Focal Child

	Coef.	Std. Error	*p*
Fixed Effects:			
Focal child talks to lead teacher	1.95	.26	.000
Focal child talks to assistant teachers	-.14	.19	.449
Focal child talks to another child	.01	.10	.919
Random Effect:			
Classroom (variance)	65.00	25.44	

Appendix D

Sensitivity Analyses

When the two outliers are removed from the sample, there are several changes to the findings. First, I examine the correlation coefficients between children's characteristics and the six child-talk variables (see Table D1). When the outliers were removed, there was no longer a significant correlation between English proficiency score and the frequency of children's talk to peers (from $r = .19$ to $r = .09$). This indicates that the outliers' low ELP scores and low frequency of talk to peers were increasing the correlation between those variables.

Table D1

Pearson's Correlation Coefficients Between Child Characteristics and Child-Talk Variables (n = 115)

	Frequency of talk to teachers	Sustained conversations with teachers	Frequency of talk to peers	Sustained conversations with peers	Frequency of English talk	Frequency of Spanish talk
Shyness	-.25**	-.08	-.11	-.08	-.21*	-.15
Inhibitory control	-.21*	-.04	.04	.17	-.10	.07
English proficiency score	.09	.07	.09	.13	.20*	-.23*
Spanish proficiency score	-.02	.09	.01	.01	-.08	.39***
Age in months	.14	.16	.00	.02	.12	-.12
Classroom quality	.17	.08	-.11	-.09	.02	.05
Gender – Female	-.08	-.06	.05	.28**	-.03	.19*
IEP	-.08	-.17	.01	-.04	-.02	-.08

* $p < .05$. ** $p < .01$. *** $p < .001$.

I re-ran the multilevel negative binomial regression models for each outcome variable to test whether the findings would change after omitting the two low-ELP children (n = 115). The corresponding regression tables are on the pages that follow. Changes to significant findings (i.e., a predictor was statistically significant when n = 117 and non-significant when n = 115 or vice versa) are highlighted in bold in the tables and described below. In some cases, ELP was only a significant predictor when n = 117, suggesting that the two outliers were driving the associations between ELP and child talk.

Child-talk models

After removing the two outliers, the effect of children's English proficiency on the frequency of their talk to teachers was no longer significant in Models 2 and 3, as shown in Table D2. English proficiency was also non-significant in the interaction model shown in Table D3, but the coefficients and p-values in the remainder of the interaction model were similar across both samples. In terms of children's sustained conversations with teachers (Table D4), while the coefficients for ELP remained the same for both samples in Models 2 and 3, they were not statistically significant without the inclusion of the outliers. These findings suggest that the outliers were the driving force behind associations between children's ELP and their talk to teachers.

In Model 3, the effect of IEP was marginally significant when n = 117 (p = .055) and statistically significant (p = .046) when n = 117. Neither of the two removed children had an IEP.

Table D2

Results of Multilevel Negative Binomial Models Predicting Child Talk to Teachers

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.839 (.059)	.012	.877 (.053)	.029	.871 (.053)	.023
Inhibitory control	.791 (.074)	.012	.768 (.069)	.003	.774 (.069)	.004

English proficiency	1.005 (.004)	.142	**1.005 (.003)**	**.107**	**1.005 (.003)**	**.094**
Gender – Female			1.051 (.115)	.650	1.034 (.113)	.757
IEP			.793 (.124)	.140	.798 (.124)	.147
Age (in months)			.994 (.013)	.658	.994 (.013)	.622
Teacher requests for lang.			1.078 (.013)	.000	1.077 (.013)	.000
Level 2 Fixed effect:						
Instructional support					1.159 (.093)	.066
Variance estimate of random effect:						
Classroom	.063 (.041)		.071 (.037)		.054 (.032)	
Wald χ^2	16.69	.001	58.85	.000	61.60	.000
df	6		10		11	
AIC	711.24		687.49		686.37	
BIC	727.70		714.94		716.56	

Note. The outcome variable is the number of cycles in which the child talked to a teacher. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 115$; classrooms, $n = 21$.

Table D3

Results of Multilevel Negative Binomial Model with Interaction Effect of Shyness and Classroom Quality on Child Talk to Teachers

	IRR (SE)	*p*
Level 1 Fixed effects:		
Shyness	.423 (.101)	.000
Inhibitory control	.753 (.064)	.002
English proficiency	**1.005 (.003)**	**.107**
Gender – Female	1.027 (.108)	.803
IEP	.732 (.112)	.041
Age	1.002 (.012)	.845
Teacher requests for language	1.076 (.013)	.000
Shyness x Instructional support	1.226 (.079)	.002
Level 2 Fixed effect:		
Instructional support	1.180 (.093)	.036
Variance estimate of random effect:		
Classroom	.053 (.031)	

Note. The outcome variable is the number of cycles in which the child talked to teachers. Incidence rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. Students, $n = 115$; classrooms, $n = 21$.

Table D4

Results of Multilevel Negative Binomial Models Predicting Sustained Conversations with Teachers

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.886 (.114)	.348	.968 (.112)	.779	.967 (.112)	.775
Inhibitory control	.991 (.176)	.958	.975 (.171)	.886	.987 (.175)	.941
English proficiency	1.010 (.007)	.131	**1.010 (.006)**	**.081**	**1.012 (.006)**	**.076**
Gender – Female			.972 (.205)	.893	.955 (.204)	.828
IEP			.458 (.174)	.040	**.469 (.178)**	**.046**
Age (in months)			1.000 (.024)	.993	.999 (.024)	.968
Teacher requests for lang.			1.126 (.028)	.000	1.126 (.028)	.000
Level 2 Fixed effect:						
Instructional support					1.109 (.154)	.456
Variance estimate of random effect:						
Classroom	.153 (.147)		.141 (.116)		.131 (.113)	
Model Wald χ^2	3.60	.308	29.66	.000	30.12	.000
df	6		10		11	
AIC	354.11		337.33		338.78	
BIC	370.57		364.78		368.98	

Note. The outcome variable is the number of sustained conversations the child had with teachers. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 115$; classrooms, $n = 21$.

In terms of the regression models of the frequency of child talk to peers, as shown in Table D5, the significant (Model 1) and marginally significant (Models 2 and 3) relationship between children's English proficiency and the frequency of their talk to peers was no longer close to significant when the outliers were removed. Similarly, when predicting children's sustained conversations with their peers, ELP was no longer a significant predictor in Models 2 and 3 when the two outliers were removed, as shown in Table D6. There were no changes to the models predicting children's talk in English across the two samples.

Table D5

Results of Multilevel Negative Binomial Models Predicting Child Talk to Peers

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.941 (.043)	.181	.943 (.044)	.201	.943 (.043)	.201
Inhibitory control	1.013 (.065)	.849	.993 (.071)	.925	.990 (.071)	.892
English proficiency	**1.003 (.002)**	**.216**	1.003 (.002)	.279	1.003 (.002)	.283
Gender – Female			1.051 (.089)	.554	1.063 (.090)	.474
IEP			1.024 (.115)	.830	1.030 (.115)	.792
Age (in months)			1.003 (.010)	.780	1.003 (.009)	.768
Level 2 Fixed effect:						
Instructional support					.938 (.052)	.250
Variance estimate of random effect:						
Classroom	.020 (.016)		.022 (.017)		.020 (.016)	
Model Wald χ^2	3.98	.263	4.47	.613	5.80	.563
df	6		9		10	
AIC	841.20		846.75		847.44	
BIC	857.67		871.46		874.89	

Note. The outcome variable is the number of cycles in which the child talked to peers. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 115$; classrooms, $n = 21$.

Table D6

Results of Multilevel Negative Binomial Models Predicting Sustained Conversations with Peers

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.966 (.131)	.798	.985 (.131)	.909	.988 (.131)	.929
Inhibitory control	1.255 (.244)	.244	.964 (.199)	.860	.950 (.194)	.804
English proficiency	1.014 (.007)	.038	**1.012 (.007)**	**.073**	**1.012 (.007)**	**.071**
Gender – Female			2.234 (.548)	.001	2.323 (.575)	.001
IEP			.856 (.280)	.638	.868 (.284)	.665
Age (in months)			1.002 (.027)	.934	1.003 (.027)	.921
Level 2 Fixed effect:						
Instructional support					.764 (.155)	.186

Variance estimate of random effect:						
Classroom	.291 (.185)		.390 (.211)		.345 (.193)	
Model Wald χ^2	7.16	.067	18.66	.005	19.92	.006
df	6		9		10	
AIC	338.88		334.01		334.29	
BIC	355.35		358.71		361.74	

Note. The outcome variable is the number of sustained conversations the child had with peers. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 115$; classrooms, $n = 21$.

Table D7

Results of Multilevel Negative Binomial Models Predicting Child Talk in English

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*P*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.933 (.031)	.039	.943 (.081)	.081	.942 (.032)	.080
Inhibitory control	.934 (.046)	.167	.923 (.048)	.125	.923 (.048)	.126
English proficiency	1.005 (.002)	.005	1.004 (.002)	.012	1.004 (.002)	.012
Spanish proficiency	.999 (.001)	.312	.999 (.001)	.256	.999 (.001)	.257
Gender – Female			1.027 (.063)	.677	1.025 (.063)	.692
IEP			.996 (.081)	.963	.996 (.081)	.964
Age (in months)			1.006 (.007)	.393	1.006 (.007)	.395
Teacher requests for lang.			1.011 (.007)	.138	1.011 (.007)	.139
Level 2 Fixed effect:						
Instructional support					1.004 (.039)	.908
Variance estimate of random effect:						
Classroom	.007 (.007)		.008 (.007)		.008 (.007)	
Model Wald χ^2	18.25	.001	22.50	.004	22.50	.007
Df	7		11		12	
AIC	832.99		837.56		839.54	
BIC	852.20		867.75		872.48	

Note. The outcome variable is the number of cycles in which the child spoke in English to either teachers or peers. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 115$; classrooms, $n = 21$.

Teacher-talk models

Among all models of teachers talk to children, there was only one change to the significance of a coefficient when I removed the outliers. In Model 2 predicting teachers' elaborations, child age was marginally significant when $n = 117$, but it was statistically significant when the outliers were removed ($n = 115$), as shown in Table D10. In Model 3 for both samples, age was a significant predictor of teachers' elaborations.

Table D8

Results of Multilevel Negative Binomial Models Predicting Overall Teacher Talk

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.936 (.027)	.025	.966 (.027)	.214	.966 (.027)	.208
Inhibitory control	1.013 (.041)	.747	1.060 (.044)	.162	1.062 (.044)	.151
English proficiency	.999 (.002)	.613	.998 (.001)	.176	.998 (.001)	.182
Gender – Female			.965 (.047)	.463	.961 (.047)	.414
IEP			.981 (.066)	.775	.982 (.066)	.782
Age (in months)			1.007 (.005)	.231	1.006 (.006)	.240
Child talk to teachers			1.018 (.004)	.000	1.018 (.004)	.000
Level 2 Fixed effect:						
Instructional support					1.043 (.047)	.350
Variance estimate of random effect:						
Classroom	.023 (.011)		.024 (.011)		.023 (.010)	
Wald χ^2	5.09	.165	28.44	.000	29.23	.000
df	6		10		11	
AIC	789.69		778.15		779.30	
BIC	806.16		805.60		809.49	

Note. The outcome variable is the number of cycles in which any teacher talked to the focal child. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 115$; classrooms, $n = 21$.

Table D9

Results of Multilevel Negative Binomial Models Predicting Teachers Repeating Child Language

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.865 (.092)	.172	.986 (.077)	.856	.981 (.076)	.804
Inhibitory control	1.110 (.166)	.487	1.569 (.181)	.000	1.586 (.183)	.000
English proficiency	1.001 (.006)	.868	.995 (.004)	.209	.995 (.004)	.212
Gender – Female			.865 (.123)	.310	.854 (.121)	.267
IEP			.952 (.199)	.816	.969 (.201)	.881
Age (in months)			1.000 (.017)	.991	1.000 (.017)	.977
Child talk to teachers			1.115 (.014)	.000	1.116 (.014)	.000
Level 2 Fixed effect:						
Instructional support					1.138 (.136)	.280
Variance estimate of random effect:						
Classroom	.125 (.093)		.162 (.076)		.147 (.071)	
Wald χ^2	2.21	.530	85.18	.000	87.25	.000
df	6		10		11	
AIC	497.25		447.88		448.76	
BIC	513.72		475.32		478.95	

Note. The outcome variable is the number of cycles in which any teacher repeated or confirmed the focal child's language. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 115$; classrooms, $n = 21$.

Table D10

Results of Multilevel Negative Binomial Models Predicting Teacher Elaboration

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.856 (.106)	.215	.982 (.079)	.816	.964 (.076)	.642
Inhibitory control	.795 (.128)	.153	1.423 (.178)	.005	1.471 (.183)	.002
English proficiency	1.003 (.007)	.636	.999 (.005)	.848	1.000 (.004)	.970
Gender – Female			.556 (.085)	.000	.535 (.081)	.000
IEP			.777 (.175)	.261	.817 (.177)	.347
Age (in months)			**.965 (.017)**	**.039**	.962 (.016)	.024
Child talk to teachers			1.165 (.017)	.000	1.166 (.016)	.000
Level 2 Fixed effect:						
Instructional support					1.306 (.114)	.002

Variance estimate of random effect:						
Classroom	.000 (.000)		.090 (.060)		.035 (.040)	
Wald χ^2	4.31	.230	132.94	.000	146.76	.000
df	5		10		11	
AIC	558.02		479.70		473.81	
BIC	571.74		507.15		504.00	

Note. The outcome variable is the number of cycles in which any teacher elaborated upon the focal child's language. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 115$; classrooms, $n = 21$.

Table D11

Results of Model with Interaction Effect of Gender and ELP on Teacher Elaboration

	IRR (SE)	*p*
Level 1 Fixed effects:		
Shyness	.958 (.075)	.584
Inhibitory control	1.495 (.184)	.001
English proficiency	1.006 (.005)	.259
Gender – Female	.558 (.083)	.000
IEP	.837 (.178)	.404
Age	.958 (.016)	.012
Child talk to teacher	1.171 (.016)	.000
Gender x ELP	.982 (.009)	.041
Level 2 Fixed effect:		
Instructional support	1.337 (.115)	.001
Variance estimate of random effect:		
Classroom	.031 (.036)	

Note. The outcome variable is the number of cycles in which a teacher elaborated on the child's talk. Incidence rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. Students, $n = 115$; classrooms, $n = 21$.

Table D12

Results of Multilevel Negative Binomial Models Predicting Teachers Giving Directions

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.908 (.048)	.070	.900 (.050)	.059	.901 (.050)	.060
Inhibitory control	.925 (.069)	.295	.918 (.079)	.322	.917 (.079)	.313
English proficiency	1.000 (.003)	.906	1.001 (.003)	.992	1.000 (.003)	.990
Gender – Female			1.007 (.095)	.991	1.008 (.096)	.936
IEP			1.099 (.140)	.458	1.098 (.139)	.462
Age (in months)			1.001 (.009)	.894	1.001 (.011)	.887
Child talk to teachers			.996 (.010)	.664	.996 (.009)	.645
Level 2 Fixed effect:						
Instructional support					.972 (.048)	.567
Variance estimate of random effect:						
Classroom	.000 (.000)		.000 (.000)		.000 (.000)	
Wald χ^2	5.55	.136	6.35	.499	6.70	.569
df	5		9		10	
AIC	667.91		675.15		676.82	
BIC	681.64		699.85		704.27	

Note. The outcome variable is the number of cycles in which any teacher gave the child directions. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 115$; classrooms, $n = 21$.

Table D13

Results of Multilevel Negative Binomial Models Predicting Teachers Requesting Language

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.942 (.051)	.272	1.012 (.046)	.800	1.012 (.046)	.816
Inhibitory control	1.003 (.075)	.968	1.137 (.077)	.059	1.140 (.078)	.055
English proficiency	1.000 (.003)	.885	.998 (.002)	.290	.998 (.002)	.297
Gender – Female			.906 (.073)	.223	.901 (.073)	.198
IEP			1.059 (.123)	.619	1.061 (.123)	.607
Age (in months)			1.011 (.010)	.250	1.011 (.010)	.255
Child talk to teachers			1.043 (.007)	.000	1.043 (.007)	.000
Level 2 Fixed effect:						

Instructional support					1.116 (.111)	.270
Variance estimate of random effect:						
Classroom	.134 (.056)		.141 (.053)		.130 (.051)	
Wald χ^2	1.24	.743	47.98	.000	48.97	.000
df	6		10		11	
AIC	666.07		639.19		640.01	
BIC	682.54		666.64		670.21	

Note. The outcome variable is the number of cycles in which any teacher requested language from the focal child. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 115$; classrooms, $n = 21$.

Table D14

Results of Multilevel Negative Binomial Models Predicting Teachers Providing Contextualized Language

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.899 (.057)	.094	.971 (.057)	.620	.971 (.057)	.616
Inhibitory control	1.111 (.096)	.220	1.152 (.101)	.108	1.156 (.102)	.099
English proficiency	.995 (.003)	.118	.992 (.003)	.010	.992 (.003)	.010
Gender – Female			1.054 (.110)	.618	1.046 (.110)	.666
IEP			.921 (.134)	.571	.923 (.134)	.581
Age (in months)			1.018 (.012)	.139	1.017 (.012)	.144
Child talk to teachers			1.038 (.009)	.000	1.038 (.009)	.000
Level 2 Fixed effect:						
Instructional support					1.116 (.138)	.372
Variance estimate of random effect:						
Classroom	.201 (.082)		.206 (.080)		.197 (.077)	
Wald χ^2	4.96	.175	27.35	.000	28.22	.000
df	6		10		11	
AIC	701.40		690.74		691.95	
BIC	717.87		718.19		722.15	

Note. The outcome variable is the number of cycles in which any teacher provided the focal child with contextualized language. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 115$; classrooms, $n = 21$.

Table D15

Results of Multilevel Negative Binomial Models Predicting Teachers' Decontextualized Language

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	1.212 (.225)	.300	1.233 (.239)	.280	1.235 (.240)	.276
Inhibitory control	.931 (.224)	.768	1.028 (.269)	.917	1.026 (.269)	.921
English proficiency	1.004 (.008)	.602	1.004 (.009)	.617	1.004 (.009)	.629
Gender – Female			.735 (.218)	.299	.742 (.221)	.317
IEP			1.118 (.448)	.780	1.114 (.447)	.787
Age (in months)			1.008 (.034)	.825	1.008 (.034)	.819
Child talk to teachers			1.008 (.027)	.757	1.009 (.027)	.736
Level 2 Fixed effect:						
Instructional support					.938 (.196)	.761
Variance estimate of random effect:						
Classroom	.404 (.250)		.368 (.236)		.363 (.236)	
Wald χ^2	1.24	.744	2.63	.917	2.72	.951
df	6		10		11	
AIC	452.52		459.12		461.03	
BIC	468.99		486.57		491.22	

Note. The outcome variable is the number of cycles in which any teacher used decontextualized language or requested it from the focal child. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 115$; classrooms, $n = 21$.

Table D16

Results of Multilevel Negative Binomial Models Predicting Teachers Reading

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	1.353 (.445)	.358	1.550 (.553)	.219	1.624 (.593)	.184
Inhibitory control	.640 (.285)	.317	.916 (.463)	.862	.876 (.448)	.796
English proficiency	.984 (.015)	.312	.979 (.016)	.190	.978 (.016)	.175
Gender – Female			.565 (.330)	.239	.593 (.347)	.372
IEP			1.256 (1.217)	.814	1.062 (1.018)	.950
Age (in months)			.977 (.065)	.728	.973 (.066)	.686
Child talk to teachers			1.114 (.056)	.032	1.123 (.057)	.022
Level 2 Fixed effect:						
Instructional support					3.023 (1.545)	.026

Variance estimate of random effect:						
Classroom	3.489 (2.242)		3.798 (2.349)		2.199 (1.702)	
Wald χ^2	2.41	.492	8.81	.267	12.33	.137
df	6		10		11	
AIC	271.24		272.67		270.14	
BIC	287.71		300.12		300.34	

Note. The outcome variable is the number of cycles in which any teacher reads to the focal child. Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 115$; classrooms, $n = 21$.

Table D17

Results of Multilevel Negative Binomial Models Predicting Teachers' Use of English

	Model 1		Model 2		Model 3	
	IRR (SE)	*p*	IRR (SE)	*p*	IRR (SE)	*p*
Level 1 Fixed effects:						
Shyness	.936 (.030)	.036	.970 (.029)	.305	.970 (.029)	.298
Inhibitory control	1.004 (.047)	.940	1.050 (.048)	.299	1.051 (.049)	.285
English proficiency	1.000 (.002)	.891	.999 (.002)	.334	.999 (.002)	.344
Spanish proficiency	1.000 (.001)	.889	1.001 (.001)	.551	1.001 (.001)	.546
Gender – Female			.955 (.050)	.379	.951 (.050)	.340
IEP			.953 (.069)	.507	.954 (.069)	.513
Age (in months)			1.008 (.006)	.183	1.008 (.006)	.190
Child talk to teachers			1.020 (.005)	.000	1.020 (.005)	.000
Level 2 Fixed effect:						
Instructional support					1.035 (.046)	.441
Variance estimate of random effect:						
Classroom	.020 (.011)		.021 (.010)		.020 (.010)	
Wald χ^2	4.57	.335	30.81	.000	31.33	.000
Df	7		11		12	
AIC	793.01		779.09		780.51	
BIC	812.23		809.29		813.45	

Note. The outcome variable is the number of cycles in which any teacher speaks to the focal child in English (any category of teacher talk). Incidence-rate ratios (IRRs) are exponentiated coefficients, with standard errors (SE) in parentheses. In all models: students, $n = 115$; classrooms, $n = 21$.

REFERENCES

Atkins-Burnett, S., Sprachman, S., & Caspe, M. (2010). *Language Interaction Snapshot with End-of-Visit Ratings (LISn+ EVR).* Princeton, NJ: Mathematica Policy Research.

Atkins-Burnett, S., Sprachman, S., Lopez, M., Caspe, M., & Fallin, K. (2011). The Language Interaction Snapshot (LISn): A new observational measure for assessing language interactions in linguistically diverse early childhood programs. In C. Howes, J. T. Downer, & R. C. Pianta (Eds.), *Dual Language Learners in the Early Childhood Classroom* (pp. 117–146). Baltimore, MD: Paul H. Brookes Publishing.

Atkins-Burnett, S., Xue, Y., & Aikens, N. (2017). Peer effects on children's expressive vocabulary development using conceptual scoring in linguistically diverse preschools. *Early Education and Development*, *28*(7), 901–920.

August, D. & Shanahan, T. (Eds.). (2006). *Developing literacy in second-language learners: Report of the National Literacy Panel on language-minority children and youth*. Mahwah, NJ: Lawrence Erlbaum Associates.

Baca Zinn, M. & Wells, B. (2000). Diversity within Latino families: New lessons for social science. In D. H. Demo, K. R. Allen, & M. A. Fine (Eds.), *Handbook of family diversity* (pp. 252–273). New York, NY: Oxford University Press.

Bailey, A. L. (in press). The discourse of explicitness: Mathematics explanatory talk and self-assessment by Spanish-speaking emergent bilingual students in elementary classrooms. *Theory Into Practice*.

Bailey, A. L., & Kelly, K. R. (2013). Home language survey practices in the initial identification of English Learners in the United States. *Educational Policy*, *27*(5), 770–804.

Bandura, A. (1997). *Self-Efficacy: The Exercise of Control*. New York: W.H. Freeman.

Barbu, S., Cabanes, G., & Maner-Idrissi, G. L. (2011). Boys and girls on the playground: Sex differences in social development are not stable across early childhood. *PLOS ONE*, *6*(1), e16407.

Barnes, E. M., Grifenhagen, J. F., & Dickinson, D. K. (2016). Academic language in early childhood classrooms. *The Reading Teacher*, *70*(1), 39–48.

Bohman, T. M., Bedore, L. M., Peña, E. D., Mendez-Perez, A., & Gillam, R. B. (2010). What you hear and what you say: Language performance in Spanish–English bilinguals. *International Journal of Bilingual Education and Bilingualism*, *13*(3), 325–344.

Booren, L. M., Downer, J. T., & Vitiello, V. E. (2012). Observations of children's interactions with teachers, peers, and tasks across preschool classroom activity settings. *Early Education and Development*, *23*(4), 517–538.

Bowne, J. B., Magnuson, K. A., Schindler, H. S., Duncan, G. J., & Yoshikawa, H. (2017). A meta-analysis of class sizes and ratios in early childhood education programs: Are thresholds of quality associated with greater impacts on cognitive, achievement, and socioemotional outcomes? *Educational Evaluation and Policy Analysis*, *39*(3), 407–428.

Bratsch-Hines, M. E., Burchinal, M., Peisner-Feinberg, E., & Franco, X. (2019). Frequency of instructional practices in rural prekindergarten classrooms and associations with child language and literacy skills. *Early Childhood Research Quarterly*, *47*, 74–88.

Bronfenbrenner, U. (1986). Ecology of the family as a context for human development: Research perspectives. *Developmental Psychology*, *22*(6), 723–742.

Bronfenbrenner, U., & Morris, P. (2006). The bioecoloigical model of human development. In R. M. Lerner & W. Damon (Eds.), *Theoretical models of human development* (5 ed., pp. 793–828). New York: Wiley.

Burchinal, M. (2018). Measuring early care and education quality. *Child Development Perspectives*, *12*(1), 3–9.

Burchinal, M., Vandergrift, N., Pianta, R., & Mashburn, A. (2010). Threshold analysis of association between child care quality and child outcomes for low-income children in pre-kindergarten programs. *Early Childhood Research Quarterly*, *25*(2), 166–176.

Buysse, V., Castro, D. C., & Peisner-Feinberg, E. (2010). Effects of a professional development program on classroom practices and outcomes for Latino dual language learners. *Early Childhood Research Quarterly*, *25*(2), 194–206.

Cabell, S. Q., Justice, L. M., McGinty, A. S., DeCoster, J., & Forston, L. D. (2015). Teacher-child conversations in preschool classrooms: Contributions to children's vocabulary development. *Early Childhood Research Quarterly*, *30A*, 80–92.

Carranza, J. A., González-Salinas, C., & Ato, E. (2013). A longitudinal study of temperament continuity through IBQ, TBAQ and CBQ. *Infant Behavior and Development*, *36*(4), 749–761.

Castilla, A. P., Restrepo, M. A., & Perez-Leroux, A. T. (2009). Individual differences and language interdependence: a study of sequential bilingual development in Spanish-English preschool children. *International Journal of Bilingual Education and Bilingualism*, *12*(5), 565–580.

Castro, D. C., Gillanders, C., Franco, X., Bryant, D. M., Zepeda, M., Willoughby, M. T., & Méndez, L. I. (2017). Early education of dual language learners: An efficacy study of the Nuestros Niños School Readiness professional development program. *Early Childhood Research Quarterly*, *40*, 188–203.

Castro, D. C., Páez, M. M., Dickinson, D. K., & Frede, E. (2011). Promoting language and literacy in young dual language learners: Research, practice, and policy. *Child Development Perspectives*, *5*(1), 15–21.

Chen, X. (2019). Culture and shyness in childhood and adolescence. *New Ideas in Psychology*, *53*, 58–66.

Chesterfield, K. B., Chesterfield, R. A., & Chavez, R. (1982). Peer interaction, language proficiency, and language preference in bilingual preschool classrooms. *Hispanic Journal of Behavioral Sciences*, *4*(4), 467–486

Connor, C. M., Vandell, D., & Sparapani, N. (2017, April). *Using assessment and the OLOS observation system to inform and promote effective early learning opportunities for young children*. Paper presented at the meeting of the Society for Research in Child Development, Austin, TX.

Connor, C. M., Morrison, F. J., & Slominski, L. (2006). Preschool instruction and children's emergent literacy growth. *Journal of Educational Psychology*, *98*(4), 665–689.

Creswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed methods research* (2nd ed.). Thousand Oaks, CA: SAGE.

De Schipper, J. C., Tavecchio, L. W. C., Van IJzendoorn, M. H., & Van Zeijl, J. (2004). Goodness-of-fit in center day care: relations of temperament, stability, and quality of care with the child's adjustment. *Early Childhood Research Quarterly*, *19*(2), 257–272.

Dewaele, J.-M., & Furnham, A. (1999). Extraversion: The unloved variable in applied linguistic research. *Language Learning*, *49*(3), 509–544.

DeYoung, C. G., & Gray, J. R. (2009). Personality neuroscience: Explaining individual differences in affect, behaviour and cognition. *The Cambridge handbook of personality psychology*, 323–346.

Dickinson, D. K. (2001). Large-group and free-play times: Conversational settings supporting language and literacy development. *Beginning literacy with language*, 223–255.

Dickinson, D. K., & McCabe, A. (2001). Bringing it all together: The multiple origins, skills, and environmental supports of early literacy. *Learning Disabilities Research & Practice*, *16*(4), 186–202.

Dickinson, D. K., McCabe, A., Anastasopoulos, L., Peisner-Feinberg, E. S., & Poe, M. D. (2003). The comprehensive language approach to early literacy: The interrelationships among vocabulary, phonological sensitivity, and print knowledge among preschool-aged children. *Journal of Educational Psychology*, *95*(3), 465–81.

Dickinson, D. K., & Porche, M. V. (2011). Relation between language experiences in preschool classrooms and children's kindergarten and fourth-grade language and reading abilities. *Child Development*, *82*(3), 870–886.

Dickinson, D. K., & Tabors, P. O. (Eds.). (2001). *Beginning literacy with language: Young children learning at home and school*. Baltimore, MD: Paul H Brookes Publishing.

Dixon, W. E., & Shore, C. (1997). Temperamental predictors of linguistic style during multiword acquisition. *Infant Behavior and Development*, *20*(1), 99–103.

Dixon, W. E., & Smith, P. H. (2000). Links between early temperament and language acquisition. *Merrill-Palmer Quarterly*, *46*(3), 417–440.

Dodge, D., Colker, L. J., & Heroman, C. (2002). *The Creative Curriculum for Preschool* (4th ed.). Washington, DC: Teaching Strategies.

Downer, J. T., López, M. L., Grimm, K. J., Hamagami, A., Pianta, R. C., & Howes, C. (2012). Observations of teacher–child interactions in classrooms serving Latinos and dual language learners: Applicability of the Classroom Assessment Scoring System in diverse settings. *Early Childhood Research Quarterly*, *27*(1), 21–32.

Duncan, S. E., and De Avila, E. A. (1998). *PreLAS 2000*. Monterey, CA: CTB/McGraw-Hill.

Dunn, L. M. & Dunn, L. M. (1997). *Peabody Picture Vocabulary Test - Third Edition*. Circle Pines, MN: American Guidance Service.

Early, D. M., Iruka, I. U., Ritchie, S., Barbarin, O. A., Winn, D.-M. C., Crawford, G. M., … Pianta, R. C. (2010). How do pre-kindergarteners spend their time? Gender, ethnicity, and income as predictors of experiences in pre-kindergarten classrooms. *Early Childhood Research Quarterly*, *25*(2), 177–193.

Eisenberg, N., Taylor, Z. E., Widaman, K. F., & Spinrad, T. L. (2015). Externalizing symptoms, effortful control, and intrusive parenting: A test of bidirectional longitudinal relations during early childhood. *Development and Psychopathology*, *27*(4), 953–968.

Farran, D., Christopher, C., Nesbitt, K., & Meador, D. (2017, April). *The value of classroom observations using behavioral measures: Setting goals for changes in practice in pre-K*. Paper presented at the meeting of the Society for Research in Child Development, Austin, TX.

Faul, F., Erdfelder, E., Lang, A.-G. & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39, 175-191.

Fernald, A., Marchman, V. A., & Weisleder, A. (2013). SES differences in language processing skill and vocabulary are evident at 18 months. *Developmental science*, *16*(2), 234-248.

Francis D. J., Lesaux N., August D. (2006). Language of instruction. In D. August & T. Shanahan (Eds.), *Developing literacy in second-language learners: Report of the National Literacy Panel on language-minority children and youth* (pp. 365–410). Mahwah, NJ: Lawrence Erlbaum Associates.

Franco, X., Bryant, D. M., Gillanders, C., Castro, D. C., Zepeda, M., & Willoughby, M. T. (2019). Examining linguistic interactions of dual language learners using the Language Interaction Snapshot (LISn). *Early Childhood Research Quarterly*, *48*, 50–61.

Fuligni, A. S., Howes, C., Huang, Y., Hong, S. S., & Lara-Cinisomo, S. (2012). Activity settings and daily routines in preschool classrooms: Diverse experiences in early learning settings for low-income children. *Early Childhood Research Quarterly*, *27*(2), 198–209.

Gámez, P. B., Neugebauer, S. R., Coyne, M. D., McCoach, D. B., & Ware, S. (2017). Linguistic and social cues for vocabulary learning in Dual Language Learners and their English-only peers. *Early Childhood Research Quarterly*, *40*, 25–37.

Gee, J. P. (2014). Decontextualized language: A problem, not a solution. *International Multilingual Research Journal, 8*, 9–23.

Gershoff, E. T., Aber, J. L., Raver, C. C., & Lennon, M. C. (2007). Income is not enough: Incorporating material hardship into models of income associations with parenting and child development. *Child Development*, *78*(1), 70–95.

Gest, S. D., Holland-Coviello, R., Welsh, J. A., Eicher-Catt, D. L., & Gill, S. (2006). Language development subcontexts in Head Start classrooms: Distinctive patterns of teacher talk during free play, mealtime, and book reading. *Early Education and Development*, *17*(2), 293–315.

Gilkerson, J. & Richards, J. A. (2008). *The LENA Natural Language Study*. Boulder, CO: LENA Foundation.

Gleason, J. B. & Ely, R. (2002). Gender differences in language development. In A. V. McGillicuddy-De Lisi & R. De Lisi (Eds.), *Biology, Society, and Behavior: The Development of Sex Differences in Cognition* (pp. 127–154*)*. Westport, CT: Greenwood Publishing Group.

Gort, M., & Pontier, R. W. (2013). Exploring bilingual pedagogies in dual language preschool classrooms. *Language and Education*, *27*(3), 223–245.

Grifenhagen, J. F., Barnes, E. M., Collins, M. F., & Dickinson, D. K. (2017). Talking the talk: translating research to practice. *Early Child Development and Care*, *187*(3–4), 509–526.

Gudiño, O. G., & Lau, A. S. (2010). Parental cultural orientation, shyness, and anxiety in Hispanic children: An exploratory study. *Journal of Applied Developmental Psychology*, *31*(3), 202–210.

Hindman, A. H., Skibbe, L. E., Miller, A., & Zimmerman, M. (2010). Ecological contexts and early learning: Contributions of child, family, and classroom factors during Head Start, to literacy and mathematics growth through first grade. *Early Childhood Research Quarterly*, *25*(2), 235–250.

Hindman, A. H., Wasik, B. A., & Bradley, D. E. (2019). How classroom conversations unfold: Exploring teacher–child exchanges during shared book reading. *Early Education and Development*, *30*(4), 478–495.

Hindman, A. H., Wasik, B. A., & Erhart, A. C. (2012). Shared book reading and Head Start preschoolers' vocabulary learning: The role of book-related discussion and curricular connections. *Early Education and Development*, *23*(4), 451–474.

Horwitz, E. (2001). Language anxiety and achievement. *Annual Review of Applied Linguistics*, *21*, 112–126.

Howes, C., Burchinal, M., Pianta, R., Bryant, D., Early, D., Clifford, R., & Barbarin, O. (2008). Ready to learn? Children's pre-academic achievement in pre-kindergarten programs. *Early Childhood Research Quarterly*, *23*(1), 27–50.

Hulme, C., Nash, H. M., Gooch, D., Lervåg, A., & Snowling, M. J. (2015). The foundations of literacy development in children at familial risk of dyslexia. *Psychological Science*, *26*(12), 1877–1886.

Huttenlocher, J., Haight, W., Bryk, A., Seltzer, M., & Lyons, T. (1991). Early vocabulary growth: Relation to language input and gender. *Developmental Psychology*, *27*(2), 236–48.

Huttenlocher, J., Waterfall, H., Vasilyeva, M., Vevea, J., & Hedges, L. V. (2010). Sources of variability in children's language growth. *Cognitive Psychology*, *61*(4), 343–365.

Jacoby, J. W., & Lesaux, N. K. (2014). Support for extended discourse in teacher talk with linguistically diverse preschoolers. *Early Education and Development*, *25*(8), 1162–1179.

Justice, L. M., Cottone, E. A., Mashburn, A., & Rimm-Kaufman, S. E. (2008). Relationships between teachers and preschoolers who are at risk: Contribution of children's language skills, temperamentally based attributes, and gender. *Early Education and Development*, *19*(4), 600–621.

Justice, L. M., McGinty, A. S., Zucker, T., Cabell, S. Q., & Piasta, S. B. (2013). Bi-directional dynamics underlie the complexity of talk in teacher–child play-based conversations in classrooms serving at-risk pupils. *Early Childhood Research Quarterly*, *28*(3), 496–508.

Keogh, B. K. (2003). *Temperament in the classroom: Understanding individual differences*. Baltimore, MD: Paul H. Brookes Publishing.

Kibler, A. K., Palacios, N., & Baird, A. S. (2014). The influence of older siblings on language use among second-generation Latino preschoolers. *TESOL Quarterly*, *48*(1), 164–175.

Kim-Cohen, J., Moffitt, T. E., Caspi, A., & Taylor, A. (2004). Genetic and environmental processes in young children's resilience and vulnerability to socioeconomic deprivation. *Child Development*, *75*(3), 651–668.

Kontos, S. (1999). Preschool teachers' talk, roles, and activity settings during free play. *Early Childhood Research Quarterly*, *14*(3), 363–382.

Laursen, B., & Hartup, W. W. (1989). The dynamics of preschool children's conflicts. *Merrill-Palmer Quarterly*, *35*(3), 281–297.

Leaper, C., & Smith, T. E. (2004). A meta-analytic review of gender variations in children's language use: Talkativeness, affiliative speech, and assertive speech. *Developmental Psychology*, *40*(6), 993–1027.

LoCasale-Crouch, J., Konold, T., Pianta, R., Howes, C., Burchinal, M., Bryant, D., … Barbarin, O. (2007). Observed classroom quality profiles in state-funded pre-kindergarten programs and associations with teacher, program, and classroom characteristics. *Early Childhood Research Quarterly*, *22*(1), 3–17.

Lobman, C., Ryan, S., & McLaughlin, J. (2005). Reconstructing teacher education to prepare qualified preschool teachers: Lessons from New Jersey. *Early Childhood Research & Practice*, *7*(2).

López, L. M., & Greenfield, D. B. (2004). The identification of preliteracy skills in Hispanic Head Start children. *NHSA Dialog*, *7*(1), 61–83.

Maas, C. J. M., & Hox, J. J. (2005). Sufficient sample sizes for multilevel modeling. *Methodology*, *1*(3), 86–92.

Magnuson, K. A., & Waldfogel, J. (2005). Early childhood care and education: Effects on ethnic and racial gaps in school readiness. *The Future of Children*, *15*(1), 169–196.

Maier, M. F., Vitiello, V. E., & Greenfield, D. B. (2012). A multilevel model of child- and classroom-level psychosocial factors that support language and literacy resilience of children in Head Start. *Early Childhood Research Quarterly*, *27*(1), 104–114.

Mashburn, A. J., Justice, L. M., Downer, J. T., & Pianta, R. C. (2009). Peer effects on children's language achievement during pre-kindergarten. *Child Development*, *80*(3), 686–702.

Mashburn, A. J., Pianta, R. C., Hamre, B. K., Downer, J. T., Barbarin, O. A., Bryant, D., … Howes, C. (2008). Measures of classroom quality in prekindergarten and children's development of academic, language, and social skills. *Child Development*, *79*(3), 732–749.

Massey, S. L., Pence, K. L., Justice, L. M., & Bowles, R. P. (2008). Educators' use of cognitively challenging questions in economically disadvantaged preschool classroom contexts. *Early Education and Development*, *19*(2), 340–360.

McCabe, P. C., & Marshall, D. J. (2006). Measuring the social competence of preschool children with specific language impairment: Correspondence among informant ratings and behavioral observations. *Topics in Early Childhood Special Education*, *26*(4), 234–246.

McCabe, A., Tamis-LeMonda, C. S., Bornstein, M. H., Cates, C. B., Golinkoff, R., Hirsh-Pasek, K.,…Guerra, A. W. (2013). Multilingual children: Beyond myths and towards best practices. *Social Policy Report, Society for Research in Child Development*, *27*(4), 2–37.

McClelland, M. M., Cameron, C. E., Connor, C. M., Farris, C. L., Jewkes, A. M., & Morrison, F.

J. (2007). Links between behavioral regulation and preschoolers' literacy, vocabulary, and math skills. *Developmental Psychology*, *43*(4), 947–959.

Meyer, L. M. (2000). Barriers to meaningful instruction for English learners. *Theory into practice*, *39*(4), 228–236.

Meyer, J. P., Cash, A. H., & Mashburn, A. (2011). Occasions and the reliability of classroom observations: Alternative conceptualizations and methods of analysis. *Educational Assessment*, *16*(4), 227–243.

Myrtil, M.J., Lin, T.-J., Chen, J., Justice, L. M., Purtell, K., & Logan, J. (2019, March). *The sequence of preschoolers' insistent behavior, teachers' intervention strategies, and conflict outcome during peer conflicts*. Poster presented at the meeting of the Society for Research in Child Development, Baltimore, MD.

National Early Literacy Panel. (2008). *Developing early literacy: Report of the National Early Literacy Panel.* Washington, DC: National Institute for Literacy.

Neuman, S. B., & Cunningham, L. (2009). The Impact of Professional Development and Coaching on Early Language and Literacy Instructional Practices. *American Educational Research Journal*, *46*(2), 532–566.

NICHD Early Child Care Research Network [ECCRN]. (2005). Pathways to Reading: The Role of Oral Language in the Transition to Reading. *Developmental Psychology*, *41*(2), 428–442.

Nicholas, H., Lightbown, P. M., & Spada, N. (2001). Recasts as feedback to language learners. *Language Learning*, *51*(4), 719–758.

Páez, M. M., Tabors, P. O., & López, L. M. (2007). Dual language and literacy development of Spanish-speaking preschool children. *Journal of Applied Developmental Psychology*, *28*(2), 85–102.

Pakarinen, E., Lerkkanen, M.-K., Poikkeus, A.-M., Siekkinen, M., & Nurmi, J.-E. (2011). Kindergarten teachers adjust their teaching practices in accordance with children's academic pre-skills. *Educational Psychology*, *31*(1), 37–53.

Palermo, F., Mikulski, A. M., Fabes, R. A., Hanish, L. D., Martin, C. L., & Stargel, L. E. (2014). English exposure in the home and classroom: Predictions to Spanish-speaking preschoolers' English vocabulary skills. *Applied Psycholinguistics*, *35*(6), 1163–1187.

Peisner-Feinberg, E. S., & Burchinal, M. R. (1997). Relations between preschool children's child-care experiences and concurrent development: The cost, quality, and outcomes study. *Merrill-Palmer Quarterly, 43*(3), 451–477.

Peisner-Feinberg, E. S., Burchinal, M. R., Clifford, R. M., Culkin, M. L., Howes, C., Kagan, S. L., & Yazejian, N. (2001). The relation of preschool child-care quality to children's cognitive and social developmental trajectories through second grade. *Child Development*, *72*(5), 1534–1553.

Pelatti, C. Y., Piasta, S. B., Justice, L. M., & O'Connell, A. (2014). Language- and literacy-learning opportunities in early childhood classrooms: Children's typical experiences and within-classroom variability. *Early Childhood Research Quarterly*, *29*(4), 445–456.

Pianta, R., Downer, J., & Hamre, B. (2016). Quality in early education classrooms: Definitions, gaps, and systems. *The Future of Children*, *26*(2), 119–137.

Pianta, R., Howes, C., Burchinal, M., Bryant, D., Clifford, R., Early, D., & Barbarin, O. (2005). Features of pre-kindergarten programs, classrooms, and teachers: Do they predict

observed classroom quality and child-teacher interactions? *Applied Developmental Science*, *9*(3), 144–159.

Pianta, R. C, La Paro, K. M., & Hamre, B. K. (2008). *Classroom Assessment Scoring System (CLASS).* Baltimore, MD: Paul H. Brookes Publishing.

Polo, A. J., & López, S. R. (2009). Culture, context, and the internalizing distress of Mexican American youth. *Journal of Clinical Child & Adolescent Psychology*, *38*(2), 273–285.

Powell, D. R., Diamond, K. E., Burchinal, M. R., & Koehler, M. J. (2010). Effects of an early literacy professional development intervention on Head Start teachers and children. *Journal of Educational Psychology*, *102*(2), 299–312.

Puma, M., Bell, S., Cook, R., Heid, C., Shapiro, G., Broene, P., … Spier, E. (2010). *Head Start Impact Study. Final Report*. Administration for Children & Families. Retrieved from https://eric.ed.gov/?id=ED507845

Raikes, H. H., White, L., Green, S., Burchinal, M., Kainz, K., Horm, D., … Esteraich, J. (2019). Use of the home language in preschool classrooms and first- and second-language development among dual-language learners. *Early Childhood Research Quarterly*, *47*, 145–158.

Ramey, C. T., & Ramey, S. L. (2004). Early learning and school readiness: Can early intervention make a difference? *Merrill-Palmer Quarterly*, *50*(4), 471–491.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical Linear Models: Applications and Data Analysis Methods*. SAGE.

Rojas, R., Iglesias, A., Bunta, F., Goldstein, B., Goldenberg, C., & Reese, L. (2016). Interlocutor differential effects on the expressive language skills of Spanish-speaking English learners. *International Journal of Speech-Language Pathology*, *18*(2), 166–177.

Roseberry, S., Hirsh-Pasek, K., & Golinkoff, R. M. (2014). Skype me! Socially contingent interactions help toddlers learn language. *Child Development*, *85*(3), 956–970.

Rothbart, M. K., Ahadi, S. A., Hershey, K. L., & Fisher, P. (2001). Investigations of temperament at three to seven years: The Children's Behavior Questionnaire. *Child Development*, *72*(5), 1394–1408.

Rudasill, K. M. (2011). Child temperament, teacher–child interactions, and teacher–child relationships: A longitudinal investigation from first to third grade. *Early Childhood Research Quarterly*, *26*(2), 147–156.

Rudasill, K. M., & Rimm-Kaufman, S. E. (2009). Teacher-child relationship quality: The roles of child temperament and teacher-child interactions. *Early Childhood Research Quarterly*, *24*(2), 107–120.

Rudasill, K. M., Prokasky, A., Tu, X., Frohn, S., Sirota, K., & Molfese, V. J. (2014). Parent vs. teacher ratings of children's shyness as predictors of language and attention skills. *Learning and Individual Differences*, *34*, 57–62.

Rudasill, K. M., Rimm-Kaufman, S. E., Justice, L. M., & Pence, K. (2006). Temperament and language skills as predictors of teacher-child relationship quality in preschool. *Early Education and Development*, *17*(2), 271–291.

Ryan, E., Bailey, A.L., & Huang, Y. (in press). Rethinking the role of transitions between activities in early childhood settings: An examination of their linguistic characteristics in two preschool classrooms. *The Journal of Early Childhood Literacy.*

Sabol, T. J., Hong, S. L. S., Pianta, R. C., & Burchinal, M. R. (2013). Can rating pre-K programs predict children's learning? *Science*, *341*(6148), 845–846.

Sawyer, B. E., Hammer, C. S., Cycyk, L. M., López, L., Blair, C., Sandilos, L., & Komaroff, E. (2016). Preschool teachers' language and literacy practices with dual language learners. *Bilingual research journal*, *39*(1), 35-49.

Sawyer, B., Atkins-Burnett, S., Sandilos, L., Hammer, C. S., Lopez, L., & Blair, C. (2018). Variations in classroom language environments of preschool children who are low income and linguistically diverse. *Early Education and Development*, *29*(3), 398–416.

Sénéchal, M., & LeFevre, J.-A. (2002). Parental involvement in the development of children's reading skill: A five-year longitudinal study. *Child Development*, *73*(2), 445–460.

Snow, C. E. (1991). The theoretical basis for relationships between language and literacy in development. *Journal of Research in Childhood Education*, *6*(1), 5–10.

Snow, C. E., Tabors, P. O., & Dickinson, D. K. (2001). Language development in the preschool years. In D. K. Dickinson & P. O. Tabors (Eds.), *Beginning literacy with language: Young children learning at home and school* (pp. 1–25). Baltimore, MD: Paul H. Brookes Publishing.

Spere, K. A., Schmidt, L. A., Theall-Honey, L. A., & Martin-Chang, S. (2004). Expressive and receptive language skills of temperamentally shy preschoolers. *Infant and Child Development*, *13*(2), 123–133.

Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly*, *21*(4), 360–407.

Storch, S. A., & Whitehurst, G. J. (2002). Oral language and code-related precursors to reading: Evidence from a longitudinal structural model. *Developmental Psychology*, *38*(6), 934–947.

Sylvester, R., & Kragler, S. (2012). A case study of children's literacy development in a voluntary pre-kindergarten classroom. *Journal of Research in Childhood Education*, *26*(1), 122–140.

Swain, M. (2005). The output hypothesis: Theory and research. *Handbook of research in second language teaching and learning*, *1*, 471–483.

Tabors, P. O., Paez, M., & Lopez, L. M. (2003). Dual language abilities of bilingual four-year olds: Initial findings from the early childhood study of language and literacy development of Spanish-speaking children. *NABE Journal of Research and Practice*, *1*(1), 70–91.

Taylor, A., Bailey, A., Cooper, P., Dwyer, C., Kramarae, C., & Lieb, B. (2007). Gender equity in communication skill. In S. Klein (Ed.), *Handbook for achieving gender equity through education* (pp. 281–303). New York: Routledge.

Tompkins, V., Zucker, T. A., Justice, L. M., & Binici, S. (2013). Inferential talk during teacher–child interactions in small-group play. *Early Childhood Research Quarterly*, *28*(2), 424–436.

Tonyan, H. A., & Howes, C. (2003). Exploring patterns in time children spend in a variety of child care activities: Associations with environmental quality, ethnicity, and gender. *Early Childhood Research Quarterly*, *18*(1), 121–142.

U.S. Department of Health and Human Services & U.S. Department of Education. (2016). *Policy statement on supporting the development of children who are dual language learners in early childhood programs*. Washington DC. Retrieved from https://www.acf.hhs.gov/sites/default/files/ecd/dll_guidance_document_final.pdf

Wasik, B. A., & Hindman, A. H. (2011). Improving vocabulary and pre-literacy skills of at-

risk preschoolers through teacher professional development. *Journal of Educational Psychology*, *103*(2), 455–469.

Wasik, B. A., & Hindman, A. H. (2014). Understanding the active ingredients in an effective preschool vocabulary intervention: An exploratory study of teacher and child talk during book reading. *Early Education and Development*, *25*(7), 1035–1056.

Weiland, C., & Yoshikawa, H. (2013). Impacts of a prekindergarten program on children's mathematics, language, literacy, executive function, and emotional skills. *Child Development*, *84*(6), 2112–2130.

Wilson, S. J., Dickinson, D. K., & Rowe, D. W. (2013). Impact of an Early Reading First program on the language and literacy achievement of children from diverse language backgrounds. *Early Childhood Research Quarterly*, *28*(3), 578–592

Yazejian, N., Bryant, D., Freel, K., & Burchinal, M. (2015). High-quality early education: Age of entry and time in care differences in student outcomes for English-only and dual language learners. *Early Childhood Research Quarterly*, *32*, 23–39.

Zill, N., & Resnick, G. (2006). Emergent literacy of low-income children in Head Start: Relationships with child and family characteristics, program factors, and classroom quality. In S. B. Neuman & D. K. Dickinson (Eds.), *Handbook of Early Literacy Research* (pp. 347–371). New York: Guilford Press.