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Exploring the relations between teachers' high-quality language features and preschoolers and kindergarteners' vocabulary learning

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Abstract

This study explored the use of sophisticated vocabulary, complex syntax, and decontextualized language (including book information, conceptual information, past/future experiences, and vocabulary information) in teachers' instructional interactions with children during the literacy block in prekindergarten and kindergarten classrooms. The sample included 33 teachers and 421 children. We examined correlations among these language features and their unique contributions to children's vocabulary learning. Teachers who used more sophisticated vocabulary also engaged in more decontextualized talk about vocabulary and past/future experiences. Additionally, teachers' use of complex syntax was uniquely associated with talk about conceptual information. Both complex syntax and conceptual information talk predicted children's vocabulary learning; however, complex syntax emerged as the sole predictor when accounting for this relationship. This finding suggests that decontextualized talk about concepts, characterized by complex language structures, may facilitate vocabulary acquisition.

Keywords: Teacher-Child Conversations; Sophisticated Vocabulary; Decontextualized Language; Complex Syntax; Children's Vocabulary; Conceptual Information Talk; Syntactic Bootstrapping

Language input of adult-child conversations is critical to children's language learning and vocabulary growth (Hoff, 2006; Khan & Justice, 2020). Specifically, sophisticated vocabulary, complex syntax, and decontextualized language (DL) have been highlighted by researchers as key high-quality language features of adult-child conversations that are

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associated with children's vocabulary development, later reading, and overall academic achievement (Dickinson & Tabors, 2001; Farrow et al., 2020; Gámez et al., 2017; Rowe, 2012, 2013; Uccelli et al., 2019). These language features are associated with the language found in texts, often referred to as academic or school language, and have been termed "high-quality" language features (Gámez, 2020; Rowe, 2012). High-quality, as opposed to quantity, refers to language that aligns with the type of input children developmentally rely on to build their repertoire of more advanced vocabulary and syntax, enabling them to engage in conceptually-challenging school conversations that support learning. Cultivating children's proficiency with school language during early childhood development, or what Hadley et al. (2022) termed an "emergent academic register", is crucial for enhancing their domain-specific linguistic competencies, which are essential for literacy achievement across academic disciplines (Schleppegrell, 2004; Uccelli et al., 2019; van Kleeck, 2014). Despite the overlap between high-quality language features associated with an academic register, limited research has examined their combined effects in teachers' speech. Consequently, there is a gap in understanding how these features interact and impact children's vocabulary acquisition in educational settings (Bowne et al., 2017; Demir et al., 2015; Dickinson et al., 2014). This is an important consideration, because children, especially culturally and linguistically diverse (CALD) children in underserved communities, may rely to different extents on specific language features of teacher talk to comprehend and use language advantageously during school conversations (Hirsh-Pasek et al., 2000). The goal of the current research is to explore distinct connections between the three high-quality language features – sophisticated vocabulary, complex syntax, and DL types – that teachers use in conversations in early childhood classroom settings to determine the extent to which each of these features, collectively, contribute to the vocabulary development of CALD children in under-resourced schools.

Theoretical Approach: Importance of Language Input to Language Learning

The primary means through which children acquire language is through conversations fostering linguistic interactions with guidance from adults (Cabell et al., 2015; Gámez et al., 2020; Kim & Yun, 2019). Within this usage-based framework, language acquisition is understood as an emergent process facilitated by engaging in communicative exchanges (Tomasello, 2003). The advanced language features used by adults during these conversations help scaffold children's complex thinking and build knowledge (Gámez, 2020). This is consistent with the Emergentist Coalition Model (Hirsh-Pasek et al., 2000), which posits that children depend on a combination of linguistic cues in speech, including syntax, vocabulary, and pragmatics, to construct linguistic representations. These representations involve processing, analyzing, and extrapolating patterns from their linguistic experiences, enabling them to abstract language structures within specific contexts. Subsequently, children employ these representations to anticipate and comprehend the meaning of language during their interactions (Beretti et al., 2020; Hirsh-Pasek et al., 2000). Essential to the theory is the recognition that differences in children's language experiences, influenced by developmental and sociocultural factors, can affect the effectiveness of specific language features in promoting language development. This is particularly important to explore in children from low-resourced and/or CALD communities who may not enter school with language skills that match school expectations (Curenton et al., 2022; Diaz & Flores, 2001; Neugebauer et al., 2020).

High-quality Language Features of Teacher Talk in Early Childhood

When children enter school, the teacher assumes a crucial role as a source of linguistic input to facilitate their language acquisition (Gómez, 2020). Systemic Functional Linguistics (SFL) has been employed as a framework to understand the “high-quality” aspects of teachers’ language, aimed at enhancing children’s vocabulary and overall language skills (Barnes & Dickinson, 2017; Dickinson et al., 2014; Gómez, 2020). This theoretical approach suggests that specific language forms and structures emerge within social contexts for communicative purposes (i.e., language register) – thus, emphasizing the functional nature of language (Schleppegrell, 2020). Consequently, children acquire proficiency in various language registers, which are different ways of communicating tailored to specific audiences, through active participation in different language communities such as their home, community, and school (Halliday, 2014).

In early childhood classrooms, teacher interactions that cultivate children’s facility with an academic or school language have been underscored, in particular, as a language register that directly links to children’s future literacy and academic achievement (van Kleeck, 2014; Schleppegrell, 2012; Rowe & Snow, 2020; Uccelli et al., 2019). In school contexts, speakers often need to communicate information that extends beyond readily accessible knowledge, and consequently, make use of more decontextualized language (DL). DL serves the purpose of conveying ideas, knowledge, or concepts that are not readily observable within the immediate context (Curenton et al., 2008; Hindman et al., 2012; Rowe, 2013). This language mirrors the language of texts and is characterized by complex language structures (forms), such as sophisticated vocabulary and complex syntax (e.g., “The birds migrate south because the climate is warmer”). These structural features of language are necessary to add specificity, enabling communicative partners to grasp the meaning of “distanced” content that goes beyond the immediate context (Rowe, 2013; Snow et al., 1995).

While children may be quite conversant with their home and everyday language, they may have less facility with school language, especially in prekindergarten and kindergarten where instructional contexts are relatively new. Furthermore, it is important to recognize that children from economically disadvantaged backgrounds may encounter barriers in accessing enriched linguistic environments, especially those conducive to school language development (Schleppegrell, 2004). Limited exposure to diverse contexts that foster a range of conversational situations linked to increased decontextualized talk contributes to these challenges (Montag et al., 2018). These limitations may stem from inadequate resources for activities like field trips, extracurricular programs, or enrichment activities, which are typically more accessible to children from higher socioeconomic backgrounds. Thus, ensuring equitable access to diverse and enriched language environments is crucial to supporting the language development of children who are vulnerable to socioeconomic disparities. Consequently, research that examines the high-quality aspects of adult language input for school contexts has underscored the importance of sophisticated vocabulary, complex syntax, and DL. These features are specifically associated with the purposes and structures of school language, and they have the potential to significantly influence children’s language development and learning within early childhood classroom settings (Hadley et al., 2022; Rowe, 2013; Rowe & Snow, 2020).

Importantly, all school language is not necessarily decontextualized. For instance, teachers may use pictures in the text to describe book events. These contextualized conversations may even include advanced language structures (e.g., “The rabbit here is running to his burrow so that he can escape this big hungry wolf who has his teeth out and

is ready to eat.”) Likewise, some DL may not be academic in nature (e.g., “Tell me a time you were scared?”), or particularly complex in structure (e.g., “What will Bear do next?”). Teachers are likely to adjust the extent to which they employ challenging features of school language, such as sophisticated vocabulary, complex syntax, and DL, based on their assessment of children’s language abilities during conversational interactions (Barnes et al., 2019).

Unfortunately, children from low-resourced communities, a substantial proportion of whom represent CALD learners, systematically have less access to comparable opportunities to engage in challenging conversations – thus, limiting their exposure to high-quality features of school language (Diaz & Flores, 2001; Justice et al., 2008; Kane et al., 2023; Neugebauer et al., 2020). This challenge is compounded by the fact that CALD students may have language practices different from the conventions of school language. The disparity between school language expectations and their home practices can undermine the value of their unique linguistic abilities within their communities (Delpit, 1995; Gardner-Neblett & Iruka, 2015). Instead of leveraging CALD children’s knowledge and language usage to facilitate engagement in challenging school conversations, Diaz and Flores (2001) caution that many teachers unintentionally create “negative zones” where instructional interactions lack depth in terms of bolstering academic content and fail to incorporate rich language features due to teachers’ misinterpretation of children’s language practices. Consequently, school conversations involve a dynamic interplay between teachers and children as conversational partners, with teachers adjusting their language based on children’s developmental level interacting with sociocultural background, while children, in turn, engage with language input aligned to their developmental level and sociocultural milieu. It is important to consider this dynamic interaction to understand the high-quality language features that promote children’s vocabulary development, especially CALD children in underserved communities.

Despite previous research highlighting the importance of three high-quality language features – sophisticated vocabulary, complex syntax, and DL – in shaping children’s vocabulary and later literacy, there is a significant gap in the literature regarding the simultaneous exploration of these features. As a result, there is a lack of comprehensive understanding regarding the relationships between these language features within early childhood classrooms and whether specific features may have differential effects on children’s vocabulary learning, particularly in high-need schools. In the following sections, we will present the existing literature to explore the connections between these high-quality language features and vocabulary development.

Sophisticated Vocabulary and Children’s Vocabulary

Children’s vocabulary development level is linked to their exposures to words in their environments (Hoff, 2006). Specifically, exposure to sophisticated words may be an important language feature to cultivate the expanding vocabularies of young children first entering school (Rowe, 2012, 2013; Vasilyeva et al., 2008). Sophisticated vocabulary refers to words that are rare or uncommon in everyday language (Schleppegrell, 2012; Uccelli et al., 2019; van Kleeck, 2015). These words are often complex, advanced, or specialized, especially within specific school contexts, and typically require a higher level of cognitive understanding (see Appendix A and Table 1 for examples of teachers’ use of sophisticated vocabulary). When adults use more challenging or sophisticated words

Table 1. Definitions and Examples of Teachers' Decontextualized Talk

Category	Definition	Example
Book Information Talk	Talk that references or elicits text recall, inferences, or predictions	"Fletcher may not want to see his friends?" "Where was Fletcher going?"
Personal Connections	Talk that references or elicits personal experiences of teacher or child	"I am going to see my brother this weekend." "Have you ever seen a butterfly?"
Vocabulary Information Talk	Talk that defines/gives examples of or elicits talk of novel words	"Siblings are your brothers and sisters." "What is a blizzard?"
Conceptual Information	Talk that references or elicits information about concepts	"Birds fly south so that they can stay warm." "Turtles can live in the ocean, but are there frogs in the ocean?"

during interactions with children, there is a positive linkage to child vocabulary growth (Barnes & Dickinson, 2017; Dickinson & Porche, 2011; Rowe, 2013; Weizman & Snow, 2001). For example, Barnes and Dickinson (2017) examined 52 teachers' academic language features during book reading to 4-year-olds in Head Start classrooms. Using a composite measure of lexical elements, which included sophisticated vocabulary, types, tokens, and lexical diversity, they found that teachers who used more challenging lexical elements with children during book reading interactions resulted in children with higher end of the year receptive vocabulary scores. Dickinson and Porche (2011) also found longitudinal associations between teachers' sophisticated vocabulary input during preschool to children's end of the year vocabulary scores in kindergarten and in fourth grade. Adult input with greater frequencies of sophisticated words may help build children's networks of knowledge which, in turn, supports greater uptake of words both in oral communication and through engagement with written texts.

Complex Syntax and Children's Vocabulary

Complex syntax is also another often overlooked, high-quality language feature. (Barnes et al., 2019; Farrow et al., 2020; Gámez et al., 2017; Schleppegrell, 2004). Studies indicate that children between the ages of 4 and 5 start demonstrating differences in their ability to process and comprehend embedded clauses within sentences (Vasilyeva et al., 2008). The variations observed in children's capacity to understand and produce complex sentences have been directly associated with the input they receive from adults, particularly in terms of the usage of complex sentence structures during interactions (Huttenlocher et al., 2002; Vasilyeva et al., 2008). As children enter the school environment, they are likely to encounter more complex language structures, which can have a significant impact on their overall language development.

Research has begun to substantiate the necessity of considering complex syntax as a high-quality structural feature of adult-child interactions (Farrow et al., 2020; Gámez et al., 2017; Grøver et al., 2022; Justice et al., 2013). Teachers' use of more complex syntax

during interactions uniquely predicted children with greater expressive (Gámez et al., 2017) and receptive (Farrow et al., 2020; Grøver et al., 2022) vocabulary growth on standardized measures in early childhood classrooms. Adult complex syntax input seems to support child syntax competency (Demir et al., 2015; Huttenlocher et al., 2002; Justice et al., 2013), and this in turn allows children to process conversations at a faster rate (Berninger et al., 2017; Fernald et al., 2006; Levine et al., 2018).

Moreover, a unique relationship exists between child syntax and language processing, which can facilitate children's ability to "bootstrap" or infer the meanings of novel words (Gleitman & Gleitman, 1992). Research has demonstrated that children as young as 18 months utilize syntax in the process of learning new words (Fisher & Gleitman, 2002). However, syntactic bootstrapping begins to have a more pronounced impact on vocabulary acquisition as children become increasingly aware of more advanced syntactic structures, typically the prekindergarten to early elementary period (Blom & Boerma, 2019; Caglar-Ryeng et al., 2019; Wagley & Booth, 2021). This highlights the important role of child syntax development in early cognitive processes (Arunachalam & Waxman, 2010; Goldin-Meadow et al., 2014; White et al., 2017), such that children must hierarchically extract information to construct meaning, resembling the cognitive processes at work (Fayol, 2017; Hudson, 1992). Consequently, the complexity of language may facilitate children's reasoning ability, resulting in a synergistic effect on their language development, which can ultimately impact vocabulary learning (Farrow et al., 2020; Grøver et al., 2022).

Decontextualized Language and Vocabulary Development

Finally, research indicates that more experiences with DL during interactions may help support child vocabulary growth (Blewitt & Langan, 2016; Dickinson & Tabors, 2001; Hindman et al., 2008, 2012; Rowe, 2013; Wasik & Hindman, 2014). A body of work exploring DL during teacher-child interactions has focused on book reading, possibly because the text may afford a potentially rich opportunity to springboard into more distanced and abstract talk (Barnes et al., 2019; Dickinson et al., 2014; Wasik & Hindman, 2014; Zucker et al., 2013). For example, Hindman et al. (2012) found that teachers used a variety of decontextualized content with Head Start preschool children during book reading, including connecting to past/future experiences, predicting, inferencing or summarizing book events, and/or providing novel information about vocabulary within the story. Using a composite measure, the findings indicated that increased DL talk predicted child vocabulary gains in the spring. However, so too did contextualized talk, with greater benefits of contextualized talk for children with lower initial vocabulary level. Interestingly, in a later study Wasik and Hindman (2014) found no effects of DL talk during shared book reading on children's vocabulary learning. More recently, Kane et al. (2023) found that teachers' DL talk across the school day with dual language learners in preschool was also inconsequential to their vocabulary gains. The mixed results suggest that specific types of decontextualized content may have varying effects on vocabulary growth, rather than simply increasing the overall frequency of DL talk.

Differences in Content Types of Decontextualized Talk to Vocabulary

Different forms of decontextualized language, referred to as "DL content types," provide and elicit distinct information – thus, facilitating children's learning. This point becomes

particularly relevant when considering children who may have less exposure to DL talk. Barnes et al. (2017) conducted an analysis of 52 teacher comments to children during book reading in Head Start classrooms and discovered that talk focused on concepts, rather than vocabulary, predicted preschoolers' vocabulary growth. Similar findings were observed in more detailed studies examining specific types of vocabulary talk. Silverman and Crandell (2010) found that vocabulary definitions, examples, and connections to other contexts did not significantly influence vocabulary learning in kindergarten children with lower initial vocabulary knowledge. Bowne et al. (2017) replicated these results in Chilean classrooms and, additionally, found that conceptual information talk, which included facts and connected to broader unit concepts, was significantly associated with children's end-of-year vocabulary scores.

Research investigating parent DL talk also suggests the importance of providing and explaining information about concepts. Rowe (2012) examined three content types of DL between parent-child dyads: explanation of concepts, narrative, and pretend talk. The results indicated that only explanations and narrative talk, but not pretend talk, uniquely predicted vocabulary gains in children at 52 months.

Collectively, these findings suggest that different content in DL talk may have varying effects on children's word learning. For children with limited exposure to school vocabulary talk, it can be challenging to connect unfamiliar words in the stream of conversations to their existing knowledge, which also has implications for the effectiveness of increased use of sophisticated words in teacher talk. Therefore, teachers may need to initially enhance background knowledge through rich, conceptually focused conversations using words that children are more familiar with and can use to comprehend challenging content (Bowne et al., 2017; Cabell & Hwang, 2020; Neugebauer et al., 2020).

Differences in Relations between High-quality Language Features

Although there is limited research on the relationship among teachers' use of sophisticated vocabulary, complex syntax, and DL content types, some evidence suggests potential patterns. Dickinson (2001a) observed that teachers' feedback loops aimed at extending conversations with children were often simple, focusing on past or future experiences and encouraging the child to talk, rather than providing linguistically challenging input. This content type of DL, which emphasizes personal experiences, may lead to a reduction in linguistic complexity, including sophisticated vocabulary and complex syntax. In a study of 14 Head Start classrooms, Barnes et al. (2019) found that teachers consistently simplified their syntax compared to the complexity of the texts they were reading. When teachers used the text as a basis for discussions on events, words, or children's experiences, their non-immediate talk about the book became simplified. Similar results regarding teachers' syntax during book reading comments have been reported by Dickinson et al. (2014) and Demir-Lira et al. (2019). However, Dickinson (2001b) found that analytical book talk correlated with the use of sophisticated words, suggesting that teachers may use books as a platform for discussing sophisticated words. Thus, it remains unclear whether there are consistent patterns between teachers' increased use of certain content types of DL and their use of sophisticated vocabulary and complex syntax. Furthermore, there is limited knowledge about whether CALD children in high-need schools rely more or less on teachers' use of sophisticated vocabulary, complex syntax, and/or DL content types during instructional conversations, which may have implications for their vocabulary learning.

Differences in Contributions of High-quality Language Features to Child Vocabulary

The limited studies that have examined DL along with either complex syntax or sophisticated vocabulary of adult talk reveal that these linguistic inputs change in their contribution to vocabulary learning when considered together. For example, Dickinson and Porche (2011) discovered correlations between teachers' use of sophisticated vocabulary with 4-year-old prekindergartners and their subsequent receptive vocabulary (PPVT) scores in kindergarten and fourth grade. However, mediation analyses that controlled for factors, such as teacher analytic book talk and extending talk in prekindergarten, revealed that sophisticated vocabulary did not independently predict fourth-grade vocabulary, nor did it indirectly influence vocabulary growth through gains made in kindergarten. Similarly, Rowe (2012) observed that parents' use of sophisticated vocabulary with their children at 30 months predicted their PPVT growth one year later. However, when accounting for DL talk types, such as parents' explanations and narrative conversations with their children at 42 months, DL talk, rather than sophisticated vocabulary, was associated with the children's receptive vocabulary growth at 52 months. This underscores how children's developmental stage influences the impact of adult language input on language development.

In another study, Demir et al. (2015) explored parent and child dyads when children were 30 months old. The interactions were recorded for 90 minutes in the home during routine activities such as mealtime, toy play, and book reading. In their regression model, controlling for parents' complex syntax, DL talk ceased to be a significant predictor of child vocabulary in kindergarten measured by the PPVT, and complex syntax of parents' utterances emerged as having a unique link to growth in child PPVT scores instead. The same pattern of findings emerged when predicting child syntax in kindergarten. The authors surmised that the structural complexity of parent talk was the driving force of children's growth in their syntax and vocabulary.

Aims of the Current Study

In our current research, we aim to investigate the relationships between three important high-quality features of teachers' input, namely sophisticated vocabulary, complex syntax, and different types of DL content (past/future experiences, conceptual information, vocabulary information, and book information). We will focus on these language features during instructional interactions in high-need early childhood classrooms. Our goal is twofold: (a) to gain a better understanding of the patterns between these high-quality language features, and (b) to examine the unique associations between each language feature and vocabulary learning in CALD children. To guide our research, we have formulated the following questions:

- Q1. What is the nature of teachers' use of sophisticated vocabulary, complex syntax, and decontextualized language when interacting with CALD children in prekindergarten and kindergarten classrooms?
- Q2. Are there relations between measures of input high-quality (sophisticated vocabulary, complex syntax, and decontextualized language)?
- Q3. Do measures of input high-quality (sophisticated vocabulary, complex syntax, or decontextualized language) uniquely predict children's spring vocabulary scores when accounting for other background factors?

Method

Context of the Study

The data for this study were collected from a previous intervention research project (see Farrow et al., 2020). In this project, teachers received online professional development, including group workshops and individualized coaching, to learn and implement research-based strategies aimed at enhancing children's vocabulary learning. These strategies involved activities such as defining words, asking questions, and promoting discussions around vocabulary. Control teachers used their districts' literacy curriculum and attended district-provided professional development. Both intervention and control teachers used three common settings during their literacy block: morning message, book reading, and small group activities. Although the intervention ostensibly carries the potential to influence high-quality language features, our prior work reported implementation fidelity to be relatively low with no effect of the intervention on children's vocabulary learning. Additionally, there were no differences in intervention and control teachers' complex syntax across literacy settings (Farrow et al., 2020). In the current study, we report differences between control and intervention teachers' talk, including sophisticated vocabulary, complex syntax, and DL content types and will control for the intervention status in all our analyses. This approach allows us to focus, specifically, on the fine-grained high-quality language features that facilitate child vocabulary acquisition, irrespective of the intervention's influence.

Participants

Teachers. During the course of the study, 33 teachers from two under resourced districts located in the Mid-Atlantic region of the United States were recorded during their literacy block sessions in both the fall and spring semesters of the academic year. Of the total participants, 58% self-reported their ethnicity as white, while 36% identified themselves as African American. There was one Hispanic/Latinx teacher and one Asian teacher. All but two were native speakers of English. All held at least a bachelor's degree and state teaching certificate, but the majority (80%) also had master's degrees. There were two male teachers in the sample.

Children. All children in each classroom were invited to participate with active parental consent. The study included a total of 421 child participants. Among them, slightly more than half of the sample (56.8%) were in preschool, while the remaining (43.2%) were in kindergarten. The average age of the children at the beginning of the academic year was 4.8 years old. District demographics report that 85% of the children were African American, and 15% were Hispanic/Latinx. Among the participants, 20% were Dual Language Learners (DLL), with 75% of them speaking Spanish at home. Additionally, all children qualified for free or reduced-price lunch programs, an index of low socioeconomic status. The sample was nearly evenly split by gender, with slightly more than half (52.5%) of the participants being female. Lastly, the standardized scores for receptive vocabulary in the fall, as assessed by the PPVT (Peabody Picture Vocabulary Test), indicated that children in PreK (with a mean score of 82.97) and Kindergarten (with a mean score of 85.52) were situated approximately one standard deviation below the mean for their respective age groups.

Procedures

Twenty teachers from each grade level, including prekindergarten and kindergarten, were recruited from two school districts. At each grade level, 10 teachers were randomly

assigned to the intervention condition, while the remaining 10 were assigned to the business-as-usual control group. Following post-testing, the sample consisted of 8 intervention and 9 control prekindergarten teachers ($n = 17$), and 8 control and 8 intervention kindergarten teachers ($n = 16$), totaling 33 teachers, with each classroom containing an average of 13 children. Attrition occurred primarily due to job transfers and teacher illness. For the purposes of this study, only videos of teachers with both pre- and post-data were included for analysis.

In September/October, each prekindergarten ($n = 17$) and kindergarten ($n = 16$) teacher were videotaped during their literacy instruction block, consisting of morning message, book reading, and small groups. Consenting children were individually and directly assessed on their vocabulary knowledge.

Intervention teachers ($n = 16$) completed nine online modules (about 1 per month) focused primarily on increasing children's use of language and vocabulary (see Farrow et al., 2020 for detailed information). Control classrooms ($n = 17$) implemented their district's language and literacy curriculum, and attended their district's PD.

In the spring, teachers ($N = 33$) were again videotaped during their literacy instruction block, and children's vocabulary was assessed again. For the current study, we coded high-quality language features of teachers in the fall and in spring. Because the fall and spring measures of teachers' complex syntax ($r = .717, p < .001$), sophisticated vocabulary ($r = .608, p < .001$), and DL content types ($p < .074$, for all 4 types) were correlated (or approaching) from fall to spring, we created composite scores for each of the language features under study (i.e., complex syntax, sophisticated vocabulary, each of the four DL content types) by averaging their fall and spring scores.

Measures

Language Samples for Structural Features of Teachers Talk

In our study, we employed two distinct methods for extracting language samples aimed at capturing both the breadth of sophisticated vocabulary and the complexity of syntax evident in teacher-child interactions. Each method was designed to address the unique nuances associated with capturing these two essential structural language features.

We undertook a systematic approach to assess sophisticated vocabulary by sampling five-minute segments of teacher talk directed towards children during instructional sessions within the literacy block. These interactions encompassed the morning message, book reading sessions, and small group activities. We implemented this sampling strategy throughout both the fall and spring semesters of the academic school year, resulting in a total of 30 minutes of recorded teacher-child interactions for each teacher included in the study ($N = 33$). This accumulation amounted to 990 minutes of language samples in total. While prior studies have utilized longer timeframes extracted from a single video of the same instructional setting (Cabell et al., 2011; Justice et al., 2018) or derived from a single day of the school year (Dickinson & Porche, 2011), our approach sought to capture a more comprehensive index of teachers' sophisticated vocabulary across diverse interactional contexts. We anticipated that interactions within varying contexts would introduce variation in topics and activities, thereby influencing structural features to some extent (Farrow et al., 2020; Hadley et al., 2023; Montag et al., 2018). Additionally, prior research has indicated that structural features of adult talk to children typically exhibit relative stability across the duration of the sample (Farrow et al., 2020; Huttenlocher et al., 2007), suggesting that shorter samples are sufficient to capture an index of complexity in

structural features (Heilman et al., 2010; Nippold et al., 2005). Considering the time-intensive nature of transcription, our decision to use shorter samples across diverse contexts and timepoints aimed to provide a more nuanced understanding of teachers' language use in instructional settings.

Likewise, to assess the complexity of teachers' syntax, language samples were taken from morning message, book reading sessions, and small group activities in the fall and spring of the school year. However, for each video, we extracted the first 100 words from conversations in each instructional context (e.g., 100 words from the fall morning message, 100 words from the fall book reading, etc.), totaling 600 words of utterances per teacher. The decision to employ 100-word samples was informed by previous linguistic research, which has established 100-word samples as a reliable metric for assessing complex syntax, facilitating the collection of multiple samples across diverse contexts (Polat & Kim, 2014; Spoelman & Verspoor, 2010). Moreover, the quantity of words produced by teachers poses a significant confounding factor in measuring complex syntax (Hutchins et al., 2005). While prior studies have addressed variability in video length (and by extension amount of talk) by implementing a video cut-off time (Huttenlocher et al., 2002) or incorporating the duration of video minutes in the computation of clausal density measures (Gámez et al., 2017), utilizing actual word counts provides a more effective method for addressing variations in the amount of talk among teachers (Hutchins et al., 2005).

Excluding Non-Instructional Talk and Book Text. We excluded non-instructional talk based on previous studies (Barnes et al., 2017; Curenton et al., 2008; Demir-Lira et al., 2019; Wasik et al., 2016). This type of talk, typically characterized by interruptions from another teacher or child (e.g., Yes, go to the bathroom) or redirection of an off-task child (e.g., Xavier, I'm not going to tell you again to put it down), which did not align with the instructional goal, were excluded from the analysis. Additionally, to capture extratextual talk, we excluded instances of teachers reading book text, which allows us to isolate teachers' language with children from the language of the text being read (Barnes et al., 2017; Dickinson & Porche, 2011; Dickinson et al., 2014; Wasik et al., 2016).

Teachers' Sophisticated Vocabulary

Transcriptions. Transcripts of the readings were formatted using the Codes for Human Analysis of Transcripts (CHAT) format from the CHILDES Project. Analysis was carried out utilizing the Child Language Analysis computer program (CLAN) developed by MacWhinney (2012). The transcription of teacher videos was performed by the first researcher and subsequently double-checked for accuracy. We broke utterances by attending to natural pauses and phrase-final intonation, which is appropriate when analyzing talk at the word level (Gámez & Lesaux, 2012; Rowe, 2012). The CHAT program has an automated procedure to check for any inaccuracies within transcriptions to CHAT conventions. This automated process was used to ensure that transcripts adhered to those conventions. Any inconsistencies were fixed before analyses were conducted.

For morning message and small group activities, we began transcriptions when the teacher indicated that an activity would begin (e.g., Let's start our morning message). During the analysis of book reading interactions, transcriptions were initiated from the first interactional stop during reading. An interactional stop was operationally defined as a pause by the teacher from reading the actual text to provide additional information to the children (e.g., "Remember, a blossom is a type of flower") or to initiate a conversation

related to the text (e.g., “Why do you think Fletcher is scared?”). This definition was established to address variations in the starting points captured by the teachers’ video recordings. Some recordings included instances where teachers prompted students to engage in turn and talk activities (e.g., “Turn to your partner and tell them a time you were scared”), discussed concepts of print (e.g., “Where do I start reading?”), or engaged in literacy-related discourse (e.g., “What does the author do?”). Conversely, other recordings began as soon as the teacher initiated reading the book. As all teachers in this study engaged in interactive book reading, transcriptions began at the first identified interactional stop to ensure consistency and to isolate teachers’ extratextual talk (Barnes et al., 2017; Dickinson & Porche, 2011).

Sophisticated words. Sophisticated words – rare and low-frequency words – were identified by filtering out high-frequency words from teachers’ transcripts. To determine whether a word was high frequency or not, we referred to the Dale-Chall list of the 3,000 words known by fourth graders (based on Chall & Dale, 1995). We followed the procedures done by past research (Dickinson & Porche, 2011; Gámez & Lesaux, 2012; Rowe, 2012) and included all forms of the base words found in the original 3,000-word list, including the following inflected forms: s, es, ies, ’s, d, ed, ied, ing, r, est, ier, iest. In addition, all transcripts were reviewed for any unconventional words (e.g., Bud, gotta), common classroom material words (e.g., journal, crayons), common praise words (e.g., wow, excellent), which were included to our expanded Dale-Chall list. Our expanded list totaled 8,148 words. Transcripts were then run against our expanded list of high-frequency words using the CLAN program. The words that remained after “filtering” were deemed “sophisticated.” For each transcript, CLAN derived the number of different sophisticated words and the number of total sophisticated words. In the current research, we calculated the proportion of total sophisticated words to teachers’ total words in order to control for differences across teachers in their amount of speech in alignment to past research (Dickinson & Porche, 2011; Gámez & Lesaux, 2012). Teachers’ sophisticated vocabulary to total word token during literacy settings was then averaged for a final fall-spring composite score (see Table 1 and Appendix A for selective examples providing a glimpse into the types of words used by teachers when interacting with children).

Teachers’ Complex Syntax

Transcriptions. We began our transcriptions for each instructional setting following the same methods as sophisticated vocabulary transcripts. However, we parsed teacher speech into C-units (communication units) according to the conventions outlined in the Systematic Analysis of Language Transcripts software (SALT; See Miller & Iglesias, 2012, for a complete overview of the conventions). The C-unit represents a complete idea, with at least one subject and one verb that cannot be divided up into smaller parts without changing its meaning. Parsing into C-units is essential when calculating complex syntax at the clausal level (Loban, 1976). Therefore, we adopted SALT conventions to facilitate this process in our analysis. For a full explanation of the process see Farrow et al. (2020).

Twenty randomly selected videos (10% of the total sample) were re-transcribed and parsed into C-units by a linguist trained through SALT and compared to the first researcher’s decisions for those same videos about C-units. We performed an interrater reliability analysis using the Kappa statistic to determine consistency among raters. The inter-rater agreement was substantial for transcribing and segmenting speech into C-units, with a Kappa value of .868.

Subordination Index. Teachers' complex syntax was conceptualized as the extent to which teachers embedded subordinate clauses in their talk to children: thus, we used a clausal density measure (Gámez et al., 2017; Huttenlocher et al., 2002). We calculated teachers' subordination index (SALT; Miller & Iglesias, 2012), which was the proportion of total clauses to total utterances (C-units). The subordination index (SI) is a metric that gauges the depth of complexity in language spoken to children, offering insight beyond merely quantifying the proportion of complex utterances. For example, consider the following utterance by a teacher containing five clauses: "That is probably why when you went outside at night you saw them because that is when they are active." Despite being a complex utterance, the SI scoring (e.g., 5 clauses within 1 utterance) illuminates the depth of complexity present. This aspect is particularly significant as it may engage children's higher cognitive abilities during this developmental stage (Delage et al., 2023). Teachers' fall and spring SI score was averaged for a final composite SI score. The Kappa statistic was .956 for calculating SI index, suggesting substantial agreement.

Teachers' Decontextualized Language

Coding Decontextualized Language. Teachers' DL was coded directly from videos in the fall and spring by the first author, with input and feedback by the second and third researcher. Each teacher's video comprised morning messages, small group sessions, and book reading activities, all centered around literacy instruction, resulting in a total of 198 videos coded. Coding commenced simultaneously with the initiation of transcriptions, as previously described, and continued until the teacher signaled the conclusion of the activity or the beginning of another (e.g., "Let's put this away and get ready for art").

The coding scheme comes from a slightly modified version of Hindman et al. (2012) and Wasik and Hindman (2014) work in determining teachers' contextualized and decontextualized talk during book reading. Importantly, we broke the stream of DL into idea-units, defined as a unique idea having a subject-verb relationship that is not a component to another idea-unit (see Appendix A). For example, a teacher may say, "A blossom is a flower, and flowers would be blooming in the spring." The first idea-unit (A blossom is a flower) would be coded as vocabulary information, while the second idea-unit (flowers would be blooming in the spring) would be coded as conceptual information. Further, a question about a book, such as "What do you think Fletcher will do next?" would be coded as book information talk, even though the sentence contains two clauses (i.e., subject-verb relation) because the noun clause (Fletcher will do next) completes the idea-unit (What do you think?). In this case the noun clause is the direct object of the sentence and is necessary to the child's understanding of the question; therefore, cannot be separated. Parsing teachers' talk at the unit of "idea" allowed us to break extended sentences and more precisely code the content types of decontextualized talk (Wasik & Hindman, 2014). Decontextualized talk could be either comments to or questions eliciting responses from children (Rowe, 2013). Each decontextualized talk was coded by content type, detailed in the next section.

Codes for Types of Decontextualized Remarks. Based on prior research identifying specific decontextualized talk, DL was categorized into four content types: book information, conceptual information, vocabulary information, and past/future experiences. (Barnes et al., 2017; Hindman et al., 2012; Rowe, 2013; Wasik & Hindman, 2014).

BOOK INFORMATION TALK refers to teacher comments or questions that ask children to summarize, infer, or make predictions about the text. Notably, book information talk

was not limited to the book reading setting; rather, we observed multiple instances of teachers incorporating discussions about the texts during morning message and small group activities. PAST/FUTURE EXPERIENCES coding included comments or questions about events in the teacher's or children's past or future. We coded VOCABULARY INFORMATION TALK that which involved comments or questions where the teacher explicitly defined or provided examples of vocabulary words, aiming to help children understand unfamiliar words and their meanings. Lastly, CONCEPTUAL INFORMATION TALK refers to teacher remarks that explain and establish relationships between instructional concepts. Unlike vocabulary talk, which provides definitions, examples, or illustrations, conceptual information focuses on breaking down abstract ideas to highlight relations and properties of those relations. The goal of these remarks is to explain and clarify concepts and their interconnections (see Table 1 for examples of DL content types).

Excluded Remarks. Remarks excluded from analyses were contextualized talk (e.g., "This is a sprout" while pointing to the picture), code-based talk (e.g., "What sound does /b/ make?"), management talk (e.g., "Today we are going to make our collages"), and repetitious talk (e.g., repeating questions or child utterances verbatim).

Additionally, we observed that teachers often initiated whole class questions or topics for discussion, such as "Turn to your partner and talk about what you like about spring." These whole class remarks were categorized as past/future experience remarks. However, if the teacher directed their attention to an individual child, those remarks were counted separately – for example, "So, Nayla, what do you like about spring?" It is important to note that individual conversations with students were coded as distinct remarks, even if the same question was used.

To account for variations in video length, decontextualized remarks during teachers' literacy instruction were calculated by dividing the total number of decontextualized remarks by the instructional minutes. This provided a DL per minute rate for each setting, ensuring a fair comparison (Gómez et al., 2017). Subsequently, the DL rates were averaged across the fall-spring period to generate a composite DL per minute score for each of the four coded DL content types.

Interrater Reliability. The first researcher trained a graduate assistant as a second coder. Videos were coded together in the first meeting. Next, the second coder scored two in the absence of the first coder to double check accuracy in coding the four decontextualized content types. Lastly, 30 videos, approximately 15% of the corpus of videos, were randomly chosen across settings from both fall and spring and re-coded by the graduate assistant. The Kappa statistic was used to assess the interrater reliability of coders. In terms of vocabulary talk, the interrater reliability exhibited a high level of agreement (Kappa = .932), while in the case of book talk, it reached a level of .817. Likewise, interrater reliability was also substantial for conceptual talk, with a Kappa coefficient of .786, and past/future experience talk demonstrated a moderate-high level of agreement, registering a Kappa value of .711.

Child vocabulary

In the fall and spring of the intervention, the children were assessed on the Peabody Picture Vocabulary Test-4 (PPVT-4; Dunn & Dunn, 2015). In this assessment, children match a spoken word to one of four pictures, assessing receptive vocabulary level. The

PPVT-4 is a standardized, norm-referenced assessment that yields raw and standard scores. For this research, raw scores were utilized in the analysis to precisely detect growth.

Results

Q1. Nature of Teachers' High-quality Language Features.

As shown in Table 2, teachers varied in their use of high-quality language features during interactions with children.

Teachers' average sophisticated vocabulary input was 0.025. The score suggests that on average children heard three sophisticated words per every 120 words during instructional interactions, or 2.5% of total words were sophisticated. The highest sophisticated vocabulary score was .05, or 5% of all words during the literacy block.

For teachers' complex syntax, results indicate that teachers' average subordination index was 1.31, indicating that children heard a complex sentence after every third sentence. Put differently, 31% of utterances were complex. However, teachers greatly varied in the extent to which they spoke complexly with one teacher speaking almost entirely with embedded complex clauses (2.11), while another essentially spoke in all simple sentences (1.06).

Table 2. Descriptive statistics of key variables

	N	Min.	Max.	Mean	SD
<i>Classroom-Level Mean PPVT Scores</i>					
PPVT Score, fall (prekindergarten)	239	46.6	81.6	62.4	11.7
PPVT Score, fall (kindergarten)	182	64.5	90.3	80.1	11.3
PPVT Score, spring (prekindergarten)	239	68.2	93.4	82.2	9.1
PPVT Score, spring (kindergarten)	182	80.1	112.5	96.7	8.5
<i>Teacher Grade</i>					
Prekindergarten	17				
Kindergarten	16				
<i>Intervention Status</i>					
Intervention	16				
Control	17				
<i>High-quality Language Features</i>					
Complex Syntax: Subordination Index	33	1.1	2.1	1.3	0.2
Sophisticated Vocabulary	33	0.01	0.05	0.03	0.01
Total Decontextualized Talk per min.	33	1.0	4.7	2.6	0.9
Conceptual Information Talk per min.	33	0.03	2.0	0.6	0.5
Book Information Talk per min.	33	0.2	2.0	0.8	0.4
Past/Future Experiences Talk per min.	33	.04	1.9	0.7	0.5
Vocabulary Information Talk per min.	33	0.1	1.3	0.5	0.3

Examination of decontextualized talk during literacy activities revealed that vocabulary talk was the least used type of decontextualized talk by teachers. The average rate of vocabulary information talk was 0.45, indicating that a little over every two minutes children heard decontextualized talk that explained or elicited talk about novel words. Conceptual information talk was heard at the average rate of 0.62 per minute, followed by teacher' past/future experience talk ($M = 0.72$). The most frequent type of DL used by teachers during the literacy block was book information talk ($M = 0.84$). Children, generally, heard slightly less than 1 remark per minute that explained or elicited children's recall or analysis of text events (see Table 2).

Q2. Correlations between High-quality Language Features.

We found that teachers' complex syntax was not associated with their sophisticated vocabulary use, $r(31) = -.22, p = .228$. For DL content types, we found that teachers who used more vocabulary information talk were also using more past/future experience talk, $r(31) = .45, p > .008$, and book information talk was approaching, $r(31) = .30, p = .087$, but teachers who used more conceptual information talk used less past/future experience talk, $r(31) = -.39, p = .025$.

Pearson correlations between teachers' DL content type per minute and teachers' use of sophisticated vocabulary and complex syntax reveal that teachers' talk about past/future experiences, $r(31) = .54, p < .001$, and vocabulary information talk, $r(31) = .48, p < .001$, were significantly correlated to teachers' use of sophisticated vocabulary during conversations with children. However, past/future experience talk was negatively associated with teachers' complex syntax, $r(31) = .40, p = .03$. That is, teachers who used greater amounts of decontextualized talk with past/future experiences spoke with less complex syntax to children. Yet, teachers who were using more conceptual information talk also were using more complex syntax, $r(31) = .62, p < .001$ (see Table 3).

Table 3. Correlations between High-quality Language Features of Teacher Talk to Children during Instructional Interactions

Teacher Talk Variables	1	2	3	4	5	6
1. Complex Syntax	–					
2. Sophisticated Vocabulary	.22 [–.52, .14]	–				
3. Vocabulary Talk	.02 [–.33, .36]	.48** [.12, .67]	–			
4. Book Talk	.21 [–.26, .48]	.28 [–.14, .68]	.30* [–.02, .59]	–		
5. Past/Future Experiences	–.40* [–.68, –.10]	.54** [.24, .74]	.45** [.13, .69]	.22 [–.19, .55]	–	
6. Conceptual Information	.62** [.38, .80]	.14 [–.14, .42]	.23 [–.22, .50]	.26 [–.04, .61]	–.39* [–.64, –.05]	–

Note: Values in square brackets indicate the 95% confidence interval for each correlation;

*indicates $p < .05$

**indicates $p < .01$

Table 4. Multilevel Regression Models of Teachers' Decontextualized Talk and Structural Features of Language on Child Spring Vocabulary Outcomes

Parameter	Model 1	Model 2	Model 3
Intercept	90.15 (1.76)	90.19 (1.64)	89.89 (1.31)
Level 1			
Gender	0.69 (1.08)	0.92 (1.08)	0.80 (1.07)
Dual Language Learner	-0.01 (1.54)	-0.28 (1.53)	-0.22 (1.35)
Fall PPVT	0.88** (0.03)	0.77** (0.03)	0.77** (0.02)
Level 2			
Sophisticated Vocabulary	-5.04 (51.69)	-	-15.12 (38.6)
Complex Syntax: SI	7.54** (2.86)	-	6.40* (1.02)
Total Decontextualized Talk	0.31 (0.65)	-	-
Conceptual Information Talk	-	2.50** (1.35)	0.72 (1.34)
Grade	-0.61 (1.25)	-0.54 (1.04)	-0.54 (1.04)
Intervention	-0.36 (1.19)	-0.42 (1.30)	-0.42 (1.30)
-2* log likelihood	1605.20	1608.16	1604.97

Note: Standard errors in parentheses

*indicates $p < .05$

**indicates $p < .01$

To examine whether correlations were due to the observed nature of language uses rather than to the influence of professional development, we ran one-way ANOVAs across our dependent variables (i.e., sophisticated vocabulary, complex syntax, and DL content types), controlling for PD status (i.e., control vs. intervention). Results showed that there were no differences between groups in teachers' complex syntax and sophisticated vocabulary, $p > .218$, for both) and DL content rates (conceptual, vocabulary, past/future, and book talk, $p > .190$, for all). That is, the relationships observed between language features do not appear to be influenced by the intervention.

Lastly, we examined whether there were variations in teachers' language features during interactions with prekindergarten and kindergarten children. One-way ANOVAs revealed no significant differences in the structural features ($p > .218$, for both) or DL content types of teachers' talk based on grade level ($p > .161$, for all). Thus, our analysis revealed that teachers in both prekindergarten and kindergarten engaged in conversations with children that demonstrated similar levels of language features typically associated with high-quality language input.

Q3. High-quality Language Features Unique Contribution to Child Vocabulary.

Finally, a multilevel linear regression model using Mplus 8.4 explored the link between teachers' sophisticated vocabulary, complex syntax, and DL at level 2 and children's vocabulary (i.e., spring PPVT-4 score) at level 1 (see Table 4).

The fully unconditional model showed that 19% of the variance in spring vocabulary scores was between teachers ($p < .001$). The final, conditional model included fall PPVT score, child gender, and DLL status at level 1; and teachers' intervention status and grade level at level 2. All variables were grand-centered.

In our first model (Model 1), we included three variables of interest as level 2 predictors: teachers' sophisticated vocabulary, complex syntax, and composite DL rates. A composite DL content score was created by combining rates (summing) of different types of DL content due to their intercorrelations. The results showed that teachers' complex syntax had a unique positive effect on children's vocabulary learning ($b = 7.54$, $p = .006$), even after accounting for teachers' sophisticated vocabulary ($b = -5.04$, $p = .922$) and total DL rate ($b = .31$, $p = .637$). Fall vocabulary scores on the PPVT were also significant predictors of spring scores on the same measure ($b = .766$, $p < .001$), with a standardized coefficient of .88 for the association between teacher's syntax and children's vocabulary scores at level 2. This suggests that children were predicted to score 88% of a standard deviation higher on spring vocabulary scores with every standard deviation (0.23) increase, or 23% increase in teachers' complex syntax (sentences).

To further explore the relationship between different types of DL content and children's spring vocabulary scores, separate follow-up models were conducted due to multicollinearity. Only teachers' higher rates of conceptual information talk were found to predict children's spring vocabulary scores ($b = 2.50$, $p < .001$). Once again, fall PPVT-4 scores significantly predicted spring scores ($p < .001$) in all DL models, with a standardized estimate of .67 for conceptual information talk. Thus, children who heard a 48% increase in conceptual understanding talk ($SD = .48$) were predicted to score 67% of a standard deviation higher in spring vocabulary scores, holding everything else constant in the model.

In the final model, teachers' sophisticated vocabulary, complex syntax, and conceptual information talk were included to determine the specific high-quality language feature contributing to children's vocabulary scores. It was found that when these three features were entered together, teachers' conceptual information talk was no longer a significant predictor ($b = 0.7$, $p = .115$), while teachers' complex syntax remained the sole predictor of children's spring vocabulary scores ($b = 6.4$, $p < .041$) with a standardized estimate of .75. Thus, accounting for everything else in the model, children were predicted to score $\frac{3}{4}$ of standard deviation higher on spring vocabulary scores with every standard deviation increase in teachers' complex syntax, while a standard deviation increase in conceptual understanding talk predicted a 26% standard deviation increase in children's vocabulary scores, although this was not significant. Once again, teachers' sophisticated vocabulary was not significantly associated with children's vocabulary scores ($b = -15.12$, $p = .696$). Consistent with previous models, fall PPVT scores predicted spring vocabulary scores ($b = 0.77$, $p < .001$). The proportion of the variance in spring PPVT scores explained by the between-level predictors (R^2) was .97, $p = .005$, while the within R^2 was .76, suggesting that the between-level variables explained an additional 21% of the variance in children's spring vocabulary scores.

Discussion

In this study, we examined associations between teachers' use of sophisticated vocabulary, complex syntax, and DL content types in instructional conversations and their unique associations to children's vocabulary learning.

We found that different types of DL may be associated with distinct patterns of language use by teachers, contributing to both their choice of vocabulary and sentence structure, ultimately impacting children's vocabulary development. Furthermore, these observed patterns of language use by teachers may indicate their adaptation and

modification of challenging language features in response to their assessment of children's abilities (Aarts et al., 2015; Barnes et al., 2019; Cabell et al., 2011; Dickinson et al., 2014).

Patterns of Teacher Talk: Relations of High-quality Features

To begin, we observed that increased use of vocabulary talk, book talk, and past/future talk were interrelated and associated with a higher likelihood of using sophisticated words. In terms of the relationship between book talk, vocabulary talk, and sophisticated words, the finding suggests teachers may utilize books as a platform to introduce and discuss sophisticated words, potentially simplifying their syntax intentionally or unconsciously to enhance accessibility for children, which could explain the lack of significant relations. Similarly, Barnes et al. (2019) found that teachers frequently engaged in talk about vocabulary words during book reading, often employing simplified syntax.

Furthermore, previous research by Dickinson (2001b) and Dickinson et al. (2014) also established a correlation between analytical book talk and the use of sophisticated words. A potential strategy employed by teachers to support vocabulary input might involve making personal connections, as evidenced by the strong relation between vocabulary and past/future experiences talk with sophisticated vocabulary.

Teachers who used more past/future experiences during conversations significantly used less complex syntax. One possible explanation is that these personal connections may be used as a simplification technique. The aim of simplification is to adjust input to make it more understandable for the listeners, aligning it with the children's level of linguistic competence, and facilitating their understanding (Bhatia, 1983). In regard to this research, when teachers used challenging words or ideas, they may utilize past/future experiences to make sophisticated words and their meanings more relatable and understandable for children. Another explanation may be that teachers use past/future experiences to encourage children to talk about words and ideas, such as "What do you like about spring?" potentially simplifying their speech to support children's participation in conversations (Cabell et al., 2011; Dickinson, 2001a).

Collectively, our findings indicate that teachers use specific language features when conversing with children, serving varied educational purposes. Hadley et al. (2022) conducted a meta-analysis examining early childhood teachers' language practices across 30 studies, revealing the use of two distinct language registers: an emergent academic register and a bridge register. These registers serve different roles in promoting children's language development and learning. While the academic register focuses on imparting abstract concepts through advanced linguistic features, the bridge register aims to actively engage children in dialogue, bridging their home and school language practices to meet individual needs. Notably in this study, vocabulary talk was more strongly associated with the bridge register, emphasizing that when teachers introduce advanced vocabulary, they connect its meaning to children's prior experiences. This approach facilitates interactive exchanges aimed at engaging children in conversation rather than solely imparting challenging content.

In our study, teachers who engaged in more conceptual information talk demonstrated a greater likelihood of using complex syntax. The purpose of providing information, explanations, and facts may have elicited more complex syntax; however, we cannot say for certain that teachers' conceptual information talk contained more complex syntax

because we did not measure the structural features of teachers' decontextualized utterances. Rather, our measure captured an index of teachers' complex syntax across instructional interactions. As a result, we can only speculate that conceptual informational talk may elicit more complex syntax as suggested in the literature (Curenton et al., 2008; Demir et al., 2015). Future research should explore both contextualized and decontextualized conceptual information talk and its corresponding structural features to further probe whether this particular type of talk may be a viable pathway to support teachers in increasing their complex syntax, in particular, to support children's language growth.

Associations between High-quality Features and Children's Vocabulary

Interestingly, our findings did not reveal a significant association between teachers' vocabulary talk (definitions, examples) and children's vocabulary learning. These results align with studies investigating teacher talk in similar contexts. For instance, Barnes et al. (2017) observed that vocabulary talk among teachers in Head Start preschools with predominantly African-American children did not significantly predict vocabulary learning. Similarly, Bowne et al. (2017) reported that the vocabulary talk of teachers in Chilean kindergarten classrooms did not effectively support children's word learning. These findings provide additional support to the current study, suggesting that the impact of teachers' vocabulary talk on children's vocabulary acquisition may be more nuanced.

Similarly, we found no association between teachers' use of sophisticated words and children's vocabulary, which aligns with Rowe's findings that controlling for parents' decontextualized explanations and pretend talk eliminated the association between sophisticated word input and children's PPVT scores at 54 months. Additionally, Dickinson and Porche (2011) reported no direct relationship between preschoolers' sophisticated vocabulary input and their vocabulary outcomes in kindergarten or fourth grade, after accounting for control variables in regression models.

Additionally, the low rate at which children heard sophisticated words (2-3 per every 100 words) also indicates the lack of in-depth talk surrounding words because we measured total sophisticated word (not total type) over total words. That is, there was little repetition of sophisticated words, which may be important to children's vocabulary learning (Marulis & Neuman, 2013).

Among the different content types of DL input, we found that conceptual information talk had the most positive relation to the vocabulary learning of the children in our study. This finding is consistent with previous research conducted by Barnes et al. (2017) and Bowne et al. (2017), which emphasized the significant predictive power of conceptually focused talk in relation to children's vocabulary outcomes, surpassing other types of teacher talk. Teachers engaging in challenging discourse about disciplinary concepts may play a crucial role in building background information to support vocabulary acquisition (Cabell & Hwang, 2020). This implies that children's vocabulary development is enhanced when they have opportunities to learn about the world through words, rather than simply learning words in isolation.

Lastly, our findings indicated that teachers' complex syntax uniquely predicted child vocabulary growth over and above teachers' sophisticated vocabulary and decontextualized language, specifically conceptual informational talk during instructional interactions. This finding sheds light on how children in this developmental

stage acquire new words and suggests that they harness the structural aspects of language, such as embedded clauses, to BUILD and LEARN from language. These findings align with prior research elucidating a noteworthy shift in the dynamic interplay between vocabulary (semantic bootstrapping) and syntax (syntactic bootstrapping) during children's developmental trajectory. Syntactic bootstrapping theory suggests that children rely on clues like how words are arranged in sentences to figure out the meanings of new words (Gleitman & Gleitman, 1992). In simpler terms, it highlights the connection between understanding words and structuring those words. Between the ages of 4 and 6 years old, children typically undergo significant growth in their syntax/grammatical competencies (Guasti, 2017; Vasilyeva et al., 2008). This developmental period coincides with their transition into formal schooling, where they encounter more advanced language interactions characterized by complex conversations and increased exposure to written text. The increasing proficiency in syntax among children in early childhood and elementary school may explain why syntactic bootstrapping starts to have a more pronounced impact on children's vocabulary acquisition, surpassing the influence of semantic bootstrapping on syntax ability (Blom & Boerma, 2019; Caglar-Ryeng et al., 2019; Wagley & Booth, 2021). In other words, children's increasing grasp of syntax appears to play a pivotal role in driving their acquisition of vocabulary. However, further research is necessary to explore the mechanisms through which teacher syntax input, child syntax ability, and syntactic bootstrapping interact to influence vocabulary acquisition.

This understanding holds particular relevance for children from economically disadvantaged backgrounds, who may face an elevated risk of language delay. Despite potential limitations in exposure to school-related vocabulary, as evidenced by standardized fall PPVT scores ($M = 84.2$), children in our study derived the greatest benefit from teachers' complex syntax in terms of vocabulary learning. This suggests that when school vocabulary breadth is restricted, children may heavily rely on syntax to infer the meanings and enhance understandings of unfamiliar words. Therefore, syntax could serve as a potential language resilience factor for at-risk children affected by environmental challenges.

Despite lower vocabulary levels, children demonstrated the cognitive capacity to engage in complex thinking by processing complex syntax, which predicted their vocabulary learning. Exposure to embedded clauses fosters relational thought and cognitive development, including processing efficiency and executive functions (Goldin-Meadow et al., 2014; Hudson, 2017; Levine et al., 2018; White et al., 2017). Moreover, the processing of complex syntax, particularly at the clausal level, engages working memory resources (Delage & Frauenfelder, 2020; Rainey et al., 2016). This suggests that exposure to higher levels of syntactic complexity may enhance children's capacity for attending to and processing language more efficiently. Consequently, this heightened linguistic engagement facilitates the abstraction of advanced linguistic features, thereby facilitating the learning process. These cumulative benefits may have supported vocabulary acquisition in culturally and linguistically diverse children from poverty-affected communities.

Prior work with younger children has shown that the complexity of syntax at the phrasal level matters for younger children, ages 2-3 (Hoff, 2006; Demir et al., 2015). Yet, studies that have precisely calculated complex syntax at the clausal level for children in prekindergarten and kindergarten, ages 4-6, have found significant effects on children's vocabulary learning (Farrow et al., 2020; Gámez et al., 2017; Grøver et al., 2022; Huttenlocher et al., 2002). Consequently, children's emerging facility with clauses to

subordinate and modify ideas may be particularly important at this developmental stage of language learning (Vasilyeva et al., 2008). This ability to use complex syntax allows for more sophisticated expression and comprehension of ideas, which can significantly impact vocabulary development and overall language proficiency.

One final point that merits discussion involves the methodological distinctions between our approach in the current paper and prior approaches in the foundational literature. As detailed above, the prior literature has explored these nuanced issues (e.g., complex syntax, decontextualized language) in a wide array of different ways that future research could carefully tease apart. For example, distinctions in how complex syntax was defined distinguish this work from that of prior research such as Barnes and Dickinson (2017), who found that syntax, as measured by MLU-w, negatively predicted vocabulary learning for a sample of primarily low-income African American children in Head Start preschools. Our work finds the opposite, and the reasons for these differences may lie in different operationalization and coding of teacher language.

First, we transcribed teacher language to parse utterances at the C-unit level (Arndt & Schuele, 2013), while Barnes and Dickinson used natural pauses to separate utterances. Both approaches have their advantages, but using C-units may reduce variability caused by idiosyncratic teacher language use, which is particularly important for complex syntax measures (Norris & Ortega, 2009). Second, because linguistic frequencies can be influenced by the length of the language sample (Hutchins, 2005), we standardized language sample sizes to word counts to account for this variation (Charest et al., 2020; Hutchins, 2005; Spoelman & Verspoor, 2010).

In contrast, Barnes and Dickinson took a more naturalistic approach by coding entire book reading sessions. Both approaches have their advantages, but because our specific aims involved untangling multiple facets of talk, we explicitly accounted for the amount of talk. Third, and most importantly, Barnes and Dickinson measured teachers' mean length of words per utterance as a proxy for complex syntax, while we measured the depth of dependent clauses within utterances, aligning with recommendations to capture clausal density (Norris & Ortega, 2009; Foster et al., 2000; Hutchins et al., 2005). Ultimately, these fine details of how syntax is captured and measured can vary significantly across rigorous studies. This variability is an important topic for future research, as these methodological differences may explain some facets of disparate results. Understanding these differences will require comparison and collaboration over time.

Practical Implications

In sum, the outcomes of our research hold significant implications, particularly in the realm of vocabulary instruction. Our results suggest that children may derive greater benefits from engaging in complex, conceptually-rich conversations rather than isolated explicit vocabulary instruction. By focusing on cultivating children's conceptual understanding through the implementation of thematic units that introduce vocabulary within overarching conceptual themes and employing content-rich methods, such as providing extended explanations and establishing connections between concepts, teachers may naturally integrate more advanced language structures, especially complex syntax, into their interactions with children (Cabell & Hwang, 2020; Leech & Rowe, 2021; Wasik & Hindman, 2020). This approach equips children to better map new words to their existing knowledge networks, thereby enhancing their vocabulary acquisition process. Notably, bolstering conceptual knowledge may be especially integral to support the vocabulary

learning of children at risk due to environmental factors. As a result, teachers should engage children in conceptually-rich and challenging conversations that incorporate complex syntax, thereby fostering equitable interactions in early childhood classrooms (Curenton et al., 2022). However, further research is needed to fine-tune specific content-rich strategies teachers can employ to support language and learning in early childhood classrooms.

Limitations of the Study

We are limited in our speculations without data on child syntax or child language processing ability to see if increased complex syntax did in fact lead to increased competency (in comprehending, producing, and processing complex syntax). More research is needed to explore complex syntax input and its connection to child language outcomes beyond vocabulary.

A second limitation was that we were unable to control the books read during book reading. Research suggests that the type of book may influence teachers' language during interactions (Dickinson et al., 2014). In this research, teachers were using a variety of books that were part of their curriculum, but some books were fiction, while others were informational. Follow-up research may want to compare decontextualized and structural language features of teacher's talk during book reading by genre of the text.

Lastly, the DL content types under study in this research came from examining instructional contexts in early childhood (book reading, morning message, small group). Yet, research has shown that other contexts, like free play, storytelling, or snack time may also be opportunities for teachers to engage in decontextualized conversations and may be a more optimal context for children to use DL (Cabell et al., 2011; Curenton et al., 2008; Dickinson & Tabors, 2001). Thus, future research should examine whether child output of DL and structural features are contributing more to language growth than just density of those language features in teachers' talk. Additionally, this research was unable to assess the specific language structures within each DL content type or explore whether conceptual information talk (both contextualized and decontextualized) cumulatively predicts vocabulary of children in under-resourced schools. More research is needed to understand the possible link between building children's conceptual knowledge and their vocabulary learning.

Competing interest. The authors declare none.

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Appendix A

Sample of Coding Scheme for Decontextualized Content Types

Example Conversation 1

Talk	Code
T: Have you ever seen a butterfly outside?	Child Past/Future Experience-question
C: I have!	Child Response No Code
T: You have? Where did you see it?	Repetition (omitted) Child Past/Future Experience-question
C: outside	Child Response No Code
T: Noelle, have you seen a butterfly outside?	Child Past/Future Experience
C: Yes.	Child Response No Code
T: I saw a few butterflies too coming to school today.	Teacher Past/Future Experience-comment

Example Conversation Talk 2

Talk	Code
T: Do you think Bear's sneeze caused the leaves to fall? (1)	Book Information-question1
C: yes!	Child Response No Code
T: You do? Why? (1)	Book Information-question1
C: He sneezed.	Child Response No Code
T: Yes, but it is what outside? (1) What's our vocabulary word? (2)	Vocabulary Information-question1 Vocabulary Information-question2
C: Autumn	Child Response No Code
T: Right. Autumn is another word for fall. (1) And what was it today at recess? (1)	Vocabulary Information-comment1 Past/Future Experience-question1
C: windy	Child Response No Code
It was windy. So, in the Autumn it can be windy out (1). So, why did the leaves fall? (2)	Teacher Expansion (omitted) Conceptual Information-comment1 Book Information-question1

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