Teaching a novel word: Parenting styles and toddlers' word learning

Ran Wei [a,*], Samuel Ronfard [b], Diana Leyva [c], Meredith L. Rowe [a]

[a] Harvard University, Cambridge, MA 02138, USA
[b] University of Toronto Mississauga, Mississauga, Ontario L5L 1C6, Canada
[c] University of Pittsburgh, Pittsburgh, PA 15260, USA

ARTICLE INFO

ABSTRACT

We examined the styles that parents adopted while teaching a novel word to their toddlers and whether those styles related to children's word learning and engagement during the task. Participants were 36 parents and their toddlers (M_{age} = 20 months). Parents were videotaped while teaching their children a name for a novel object. Parental utterances were transcribed verbatim and coded for cognitive and autonomy support. Children's utterances were coded for elicited and spontaneous contributions. Children's ability to recognize and process the novel word was assessed using the Looking-While-Listening task. Two parental cognitive support styles were identified via cluster analysis: "Cognitive Scaffolders," who combined a diversity of teaching moves, and "Labelers," who focused on labeling the novel object for the children. Similarly, two parental autonomy support styles were identified: "Followers," who focused on following the children's lead and providing positive feedback, and "Non-followers," who used diverse communicative ways to engage the children. Compared with parents who were Labelers, parents who were Cognitive Scaffolders were not more or less likely to be Followers. Children of Cognitive Scaffolders were better at recognizing the novel word, and children of Followers were more engaged (provided more elicited and spontaneous contributions) in the word-teaching task. Children's ability to recognize the novel word was not related to their engagement. Findings highlight the

* Corresponding author.
    E-mail address: ran_wei@g.harvard.edu (R. Wei).

unique contributions of parental cognitive and autonomy support to children's word learning and engagement.

Introduction

To learn new words, toddlers need to hear them used. Indeed, parents who use a larger diversity of words with their children have children with larger vocabularies (e.g., Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010; Pan, Rowe, Singer, & Snow, 2005). However, parents not only vary in how many different words they say to their children but also differ in the *style* in which they use those words. Some parents elaborate on novel objects *and* ask children questions about novel words and their referents, some focus primarily on labeling, and some use novel words without providing support for understanding their meanings. Parents also differ in how they manage their children's attention and interest. Some parents follow their children's attention and provide positive feedback (e.g., "Good job!"), and others are less likely to do so. In this study, we examined how parents spontaneously interact with their toddlers when teaching them a name for a novel object to better understand how parents' interaction styles may shape their toddlers' word learning and engagement.

Parenting and word learning

Hindman and Morrison (2012) posited that two dimensions of parenting are important to children's learning: a cognitive dimension and an affective dimension. The *cognitive* dimension involves domain-specific supports that parents provide to help children acquire knowledge and skills in various learning situations. The *affective* dimension involves domain-general supports that parents provide to help children maintain their engagement in learning tasks.

Cognitive dimension

Three cognitive supports that adults frequently and spontaneously use to teach novel words are labeling (Echols & Marti, 2004; Tomasello & Merriman, 1995), asking questions, and commenting on novel objects (Ard & Beverly, 2004; Blewitt, Rump, Shealy, & Cook, 2009; Justice, Meier, & Walpole, 2005). These cognitive supports elicit active participation from the child because they focus the child's attention on the novel word and provide the child with opportunities to produce and/or comprehend the novel word (Blewitt & Langan, 2016).

One methodological approach to investigating the relations between these cognitive supports and language development is variable centered. This approach examines associations between *individual* cognitive supports (e.g., asking questions about the target object) and child outcomes (e.g., vocabulary). For example, researchers' questions and comments about novel words during book reading are associated with preschoolers' expressive and receptive knowledge of target words (Ard & Beverly, 2004; Blewitt et al., 2009; Ewers & Brownson, 1999; Justice et al., 2005; Sénéchal, 1997) and size of receptive vocabulary (Roberts, Jergens, & Burchinal, 2005). The variable-centered approach has been useful in identifying specific supports that promote learning. The fact that diverse cognitive support strategies frequently co-occur and are associated with the same outcomes suggests that it may be the way that adults naturally *combine* these cognitive supports, rather than variability in their use of *individual* cognitive supports, that matters more for word learning. The current study addressed this gap in research.

One way to accomplish this is to use a person-centered approach. This approach identifies styles based on the naturally occurring *combinations* of cognitive supports used by parents (at the individual level) using statistical techniques such as cluster analysis (Bergman, Magnusson, & El Khouri, 2003). Using this approach, previous research identified three parental styles supporting word learning in book-reading contexts (Haden, Reese, & Fivush, 1996): a describer style focused on labeling and

describing, a comprehender style focused on asking inferential questions and making predictions, and a collaborator style focused on providing positive feedback and asking questions to engage the child in the conversation. Parents who were taught to use a describer style in book reading had preschoolers with larger receptive vocabularies than parents who were taught to use other styles (Reese & Cox, 1999).

Affective dimension

One aspect of the affective dimension of parenting critical to children's learning is autonomy support. According to self-determination theory (Deci & Ryan, 1987), individuals have a need for autonomy, that is, a need to have a choice and a sense of agency in their actions. The ways that parents can support their children's autonomy include following the child's initiative and perspective (rather than imposing the parents' own agenda), providing positive feedback, and avoiding controlling the child's actions (e.g., taking over in order to solve the problem(s) for the child) (Grolnick & Pomerantz, 2009). Parents who support their children's autonomy in learning situations have children who feel competent, motivated, and engaged and, therefore, benefit more from such learning opportunities (Grolnick, Gurland, DeCourcey, & Jacob, 2002).

To our knowledge, no studies have specifically examined the relation between parental autonomy support styles and word learning in word-teaching situations, although some studies include components of autonomy-supportive communication (e.g., providing positive feedback) when studying parents' cognitive support for their children's word learning (e.g., Haden et al., 1996; Tamis-LeMonda, Sze, Ng, Kahana-Kalman, & Yoshikawa, 2013). Studies on joint attention indicate that parents' references to objects their children were already attending to, but not attempts to redirect the children's attention, are positively associated with children's vocabulary growth (Tomasello & Farrar, 1986; Tomasello & Todd, 1983). However, this body of work focuses on parents' individual attempts to manage and maintain their children's attention. It is unclear whether and how parents may combine different types of autonomy support moves into specific styles and whether distinct autonomy support styles are associated with children's word learning. For example, frequently combining following children's attention with positive feedback might promote children's learning.

Studies examining autonomy support in situations other than word learning have primarily used a variable-centered approach and have found positive associations between autonomy support (e.g., following the child's pace) and child outcomes (e.g., executive function) from infancy through the preschool years (e.g., Bernier, Carlson, & Whipple, 2010; Bibok, Carpendale, & Müller, 2009; Hammond, 2002). One study used median-split techniques to identify groups of high versus low autonomy-supportive parents based on frequency of autonomy-supportive moves such as following the child's agenda in conversations (Cleveland & Reese, 2005). However, these techniques impose somewhat arbitrary cutoffs to create group membership because individuals who are closer to the median are less stable in their category than individuals who are further from the median. A person-centered approach is considered a more appropriate method for this type of analysis because it tests for internal homogeneity (individuals within a group should be similar) and external heterogeneity (individuals in different groups should be dissimilar; groups should be well isolated from each other) (Bergman et al., 2003).

The role of children's engagement in word learning

Children's engagement in learning situations shapes what and how much they learn (Downer, Rimm-Kaufman, & Pianta, 2007; Fredricks, Blumenfeld, & Paris, 2004). For example, children who actively responded to adults' questions in book-reading contexts, either by saying the target word or by pointing to the corresponding object, had more advanced comprehension of the novel word than children who only listened to the story (Sénéchal, Thomas, & Monker, 1995). Indeed, the influence of parents' talk during book reading on child vocabulary outcomes is mediated by children's attention (Malin, Cabrera, & Rowe, 2014). Hence, it is important to study the role of children's engagement in their word learning. In this study, we examined children's behavioral engagement, specifically whether children made verbal and nonverbal contributions in a word-teaching task and whether these contributions were elicited or spontaneous. Spontaneous contributions by children might show an

increased level of *proactive* involvement in the task that is not captured by elicited contributions prompted by parents.

Very few studies have simultaneously examined the unique contributions of cognitive and autonomy support to child outcomes. Those that have examined these dimensions together find that they make fairly independent contributions to learning and engagement. Whereas the cognitive dimension of parenting is often related to acquiring knowledge and skills, the affective dimension of parenting is more associated with learning through engagement and motivation (Cleveland, Reese, & Grolnick, 2007; Deci & Ryan, 1987), suggesting that these two constructs are relatively independent from one another. More specifically, Cleveland and Reese (2005) found that mothers who scored higher in cognitive support during a joint reminiscing task did not necessarily score higher in autonomy support. Differential effects of the cognitive and affective dimensions of parenting on child outcomes have also been reported (Cleveland et al., 2007; Leyva, Reese, Grolnick, & Price, 2009). For example, parent cognitive support in a joint reminiscing task related to children's autobiographical memory in an independent reminiscing task, whereas parent autonomy support during joint reminiscing related to children's engagement in the independent reminiscing task.

The current study

This study addressed important gaps in prior literature on parental cognitive and autonomy support in relation to children's word learning. First, studies on parental cognitive support have almost exclusively used book reading as the word-teaching context. Although book reading is a quintessential context for word learning (Bus, van IJzendoorn, & Pellegrini, 1995), using more controlled settings (i.e., word-teaching task involving a nonsense word) can complement prior work while ruling out potential confounding factors such as prior exposure to the target word. Moreover, a more controlled setting can provide a balance between experimental consistency and the opportunity to observe spontaneous parental behaviors. Second, prior work has not examined differential contributions of parent cognitive and autonomy support to children's word learning and engagement in a word-teaching task. Third, prior work has focused on *offline* measures of expressive and receptive word knowledge (Ard & Beverly, 2004; Blewitt et al., 2009) and size of vocabulary (Roberts et al., 2005), but it has not explored children's ability to process and recognize the words they are taught in real time (i.e., word recognition). Finally, prior studies have focused primarily on the preschool years; less attention has been given to the toddler years. In light of these gaps, we investigated three research questions:

1. What cognitive and autonomy support styles do parents adopt in a word-teaching task with their 18- to 24-month-old toddlers, and are these styles related to each other?
2. Are parents' styles in a word-teaching task related to children's word recognition and engagement?
3. Is children's word recognition related to their engagement?

We expected to find variability across parents in their styles, reflecting different combinations of cognitive and autonomy support. In light of prior work on parental styles during joint reminiscing, we hypothesized independence between cognitive and autonomy support styles and expected unique associations with child outcomes, such that particular cognitive support styles would be related to children's word recognition and particular autonomy support styles would be related to children's engagement. We also hypothesized that children's word recognition would be related to their engagement in the task.

Method

Participants

A total of 42 families with typically developing children aged 18–24 months participated in this study. From this group, three families were excluded because English was not the children's primary language at home. An additional three families were excluded because the children did not yield

codable word-learning data. This resulted in a final sample of 36 families with 18 boys and 18 girls. Children's mean age was 20.08 months (SD = 1.99). All parents who participated in this study were primary caregivers; most (69%) of them were European American, and the remaining 31% were African American, Latino, Asian, or multiracial. All parents in this study had received at least some college education. On average, parents received 17.44 years of formal education (SD = 1.04, range = 14–18). Families were recruited through direct mailings to parents of 15- to 23-month-olds in a northeastern U.S. city and advertisements at local child-care centers and online parents' groups.

Procedure and measures

Parents and children came to a university laboratory for a 40- to 60-min visit. Parent–child dyads completed a word-teaching task. Children then completed the Looking-While-Listening (LWL) task, an executive functioning task, and a fast-mapping task, and parents completed four surveys. The focus of this study was on the parents' teaching styles and their children's word recognition, so we report data from the word-teaching task, the LWL task, and two parental surveys (a demographic survey and the MacArthur–Bates Communicative Development Inventory [CDI] short form).

Word-teaching task

This task was used to measure parents' cognitive and autonomy support in a word-teaching context. The parent and child were given a picture of a novel creature (see Appendix A) and a wordless picture book (*Good Dog Carl*). The book did not include the novel creature or the distractor used in the subsequent LWL task (see Appendix B). Parents and children were left alone in a room with a small table and chairs and were videotaped interacting for 8 min. Parents were asked to teach children that the novel creature in the picture was called a "Wug." Parents were free to switch among teaching the word "Wug," reading the book, or just hanging out in the room. This study reports on the interactions related to Wug teaching.

Looking-While-Listening task

The LWL task is widely used to assess children's real-time lexical processing (Fernald & Marchman, 2012; Hurtado, Marchman, & Fernald, 2007). In the literature, children's *word learning* may refer to a variety of skills, processes, and outcomes and has been studied using various measures and paradigms (Akhtar, Jipson, & Callanan, 2001; Axelsson & Horst, 2013; Bion, Borovsky, & Fernald, 2013; Blewitt et al., 2009; Naigles & Hoff-Ginsberg, 1998; Tomasello & Farrar, 1986). The current study used the LWL task to measure the amount of time toddlers spent looking to the target as an indicator of whether they successfully *recognized* the word "Wug" upon hearing it.

After the word-teaching task, the parent and child were taken to a testing room for the LWL task (adapted from Fernald, Marchman, & Weisleder, 2013). The parent sat approximately 8 feet in front of a 46-in. LED television screen with the child sitting in her or his lap. The parent was asked to put on opaque glasses, so that she or he could not see the video on the screen and her or his gaze would not guide the child's gaze. The child watched a 6-min video of 40 trials, with each trial lasting 7 s. Two videos were made with different trial orders, and each one was presented to half of the children randomly. During each trial, colorful pictures of two objects were aligned horizontally on a gray background on the screen. Of the 40 trials, 32 displayed two familiar objects (e.g., a dog and a cat). In the other 8 trials, the Wug was juxtaposed with the same distractor, another novel creature (see Appendix B). The target object was presented an equal number of times on both sides of the screen and never appeared more than three times in a row on either side. Hence, no clear pattern was available for the child to anticipate where the target object might appear. During each trial, the child was shown the paired objects for 2 s and then auditory stimuli were played, directing the child to look to the target object: "Look at the Wug! Can you find it?" or "Where is the Wug? Do you like it?" A female English native speaker recorded the auditory stimuli. To better capture the child's attention, the auditory stimuli resembled naturalistic baby talk; the sentences were clearly pronounced, were slow in speed, and had exaggerated tones. The two types of carrier phrases (i.e., "Where is the ____?" and "Look at the ____") were the same across trials and were matched for acoustic features, including duration, fundamental frequency contour, altitude, and volume using Praat, a software program for

analyses of speech phonetics (Boersma, 2001). The target word "Wug" was concatenated to the carrier phrases using Praat. The number of times "Wug" followed each carrier phrase was balanced across trials.

The pictures of the target object and the distractor object remained on the screen when the auditory stimuli were played and disappeared 1 s after the sound offset. The screen was blank for 1 s between trials. After each group of 4 trials, a 3-s animation was played to keep the child interested and engaged. The child's eye movements were recorded with a hidden video camera as he or she watched the video. The high-resolution recordings were later coded to identify the child's looking patterns.

MacArthur–Bates communicative development inventory

The CDI short form was used to assess children's vocabulary knowledge (Fenson et al., 2007). In this inventory, parents reported children's developing expressive vocabulary skills. To fully capture the individual differences in children's existing word knowledge, CDI raw scores, instead of normed percentiles, were used in subsequent data analyses. The mean score was 42.31 (SD = 27.32). We controlled for child vocabulary because some studies have shown that children's existing vocabulary was associated with their ability to acquire new words (Bion et al., 2013; Blewitt et al., 2009) and to process familiar words as measured with the LWL paradigm (Fernald et al., 2013; Hurtado et al., 2007), whereas other studies did not find associations between children's vocabulary knowledge and their ability to acquire novel labels (Lucca & Wilbourn, 2018) or to process familiar words (Bergelson & Swingley, 2013).

Coding

Parent–child interactions during the word-teaching task were transcribed verbatim by a trained reliable transcriber and then verified twice by additional research assistants using CHAT (Codes for the Analysis of Human Language) rules and codes (Child Language Data Exchange System [CHILDES]; MacWhinney, 2000). The unit of transcription was an utterance, defined as any sequence of words or communicative actions that is preceded and followed by a customary pause between sentences, an acoustic marker, an interruption, a change in conversational turn, or a change in intonational pattern (Rowe, 2012). The transcripts were then coded to determine the content of each utterance: Wug-related, book-related, or neither. A Wug-related utterance did not necessarily include the word "Wug." If the content of the utterance was related to Wug (e.g., "Is it pink?"), it counted as a Wug-related utterance. If an utterance was related to both Wug and the book (e.g., "Is there a Wug in the book?"), it was classified as Wug-related. One fourth (25%) of the transcripts were randomly selected and independently coded by the first author and a trained assistant. Coder agreement was 90.5% (Cohen's kappa = .83). Only Wug-related utterances were included in the analysis.

Parents' cognitive support in the word-teaching task

Parental Wug utterances were coded for four types of mutually exclusive cognitive support moves, drawing from previous work (Blewitt et al., 2009; Justice et al., 2005; Roberts et al., 2005): (a) parent labels or acts on Wug (e.g., "This is a Wug"); (b) parent asks child to label or act on Wug (e.g., "What is this?"); (c) parent provides information about Wug (e.g., "These are the Wug's ears"); and (d) parent asks child to provide information about Wug (e.g., "What color is the Wug?"). See Table 1 for a detailed description of this coding scheme. An utterance received no code if it did not fit into any of the four categories. We coded all Wug-related utterances for these moves, including utterances without the word "Wug," because some parental utterances that do not contain the word "Wug" may also have contributed to children's learning (e.g., parent pointed to the Wug and asked "Do you remember what this is called?"). One fourth (25%) of the transcripts were double coded, yielding an inter-rater agreement of 89.79% (Cohen's kappa = .87). Parents received four scores, one for each type of move based on the frequency of utterances containing such move.

Table 1
Coding scheme for parental cognitive support.

Type of move	Definition	Examples
Labeling/Acting on the Wug	Parent labels the Wug or performs simple physical actions to the Wug	"This is a Wug." "Wug." "Mommy gives the Wug a kiss."
Providing information about the Wug	Parent provides information about the Wug or confirms additional information the child provides	"This is Wug's ear." "I don't know if there's a Wug in that book." "Right! That's Wug's ear."
Asking the child to label/act on the Wug	Parent asks the child to label the Wug or perform physical actions to the Wug (e.g., find the Wug, retrieve the Wug, look at the Wug). In response to such requests, the child only needs to process the label but not any additional information about the Wug.	"What is this?" [parent points to the Wug] "Tickle the Wug." "Where is the Wug?" [parent hides the Wug] "Can you give Wug a kiss?"
Asking the child to provide information about the Wug	Parent asks the child to provide additional information about the Wug	"What is this?" [parent points to the Wug's eye] "Do you think the Wug has four feet?"

Parental autonomy support in the word-teaching task

Parental Wug utterances were coded for three types of mutually exclusive autonomy supportive moves based on previous work (Cleveland et al., 2007; Matte-Gagné, Harvey, Stack, & Serbin, 2015): (a) parent provides positive evaluation to child's contributions (e.g., "A Wug that's right"); (b) parent follows the child's interest, attention, and/or pace (e.g., parent asks "Is the Wug pink?", child points to the Wug's ear and says "ear," and parent replies "You found his ear!"); and (c) parent redirects child's attention and/or interest in an attempt to follow her or his own agenda (e.g., parent asks "What color is the Wug?", child points to the Wug's ear, and parent says "No, what color?") (see Table 2 for a full description). Utterances that did not fit into any of these three moves were not coded. Again, 25% of the transcripts were double coded, yielding an inter-rater agreement of 87.72% (Cohen's kappa = .82). Parents received three scores, one for each move based on the number of utterances containing that move. Note that the redirect move reflects parental control, the opposite of autonomy support. Conceptually, autonomy support and control are opposite ends of the same continuum (Grolnick et al., 2002).

We coded parents' Wug-related utterances in two separate passes. In the first pass, we coded for cognitive supports. In the second pass, we coded for autonomy support. Therefore, an utterance could be coded as either a cognitive scaffolding move, an autonomy support move, both, or neither.

Children's word recognition

We assessed one key aspect of word learning: lexical recognition and processing. Specifically, a child's success in recognizing and processing the word "Wug" was measured by whether the child

Table 2
Coding scheme for parental autonomy support.

Type of move	Definition	Examples
Providing positive evaluation	Statements that confirm or affirm the child's actions and responses. Parent repeating what the child says is considered a positive evaluation.	"Good job!" "You're right." "Yes that's the Wug's eye."
Following the child's interests	Requests or statements that follow the child's interest, take the child's perspective, and/or follow the child's pace (following child's agenda rather than parent's agenda)	Parent: "What color is the Wug?" [Child points to the Wug's eye] Parent: "That's the Wug's eye."
Redirecting the child's attention	Requests or statements that redirect the child's attention and/or interest in order to follow the parent's agenda	Parent: "Where's the Wug's feet?" Child: "Eye." [points to the Wug's eye] Parent: "No where's his feet?"

successfully recognized the target object upon hearing the word "Wug" on LWL trials. ELAN, a software program for creating annotations on language-related video and audio resources, was used to identify codable LWL trials and to code children's eye gaze during those trials. First, a highly trained coder who was blind to the target side and the hypotheses of this study identified codable trials. A trial was marked as non-codable and excluded from eye gaze coding if the child was fussy or distracted during the trial. The second author independently identified codable trials for 25% of the participants, and the average agreement between the coder and the second author was 98%. The codable trials were then coded for children's eye gaze by the same trained coder. On each 33-ms frame following the onset of the word "Wug," the coder indicated whether the child was looking to the left picture, looking to the right picture, shifting gaze between the pictures, or looking away from the screen. Frames beyond 1800 ms after word onset were not coded because children should have fully processed the acoustic information by the 1800-ms threshold and any gaze shift occurring later than that was likely due to irrelevant factors such as habituation (Fernald, Zangl, Portillo, & Marchman, 2008). The second author independently coded 25% of the sessions. The average reliability for gaze coding between the coder and the second author was 99%. The mean proportion of shifts in gaze on which the coder and author agreed within one frame was 97%, which was a more conservative measure of coder agreement.

Within the coding window (300–1800 ms after word onset), a child's proportion of accuracy on each trial was calculated as the number of segments where the child fixated on the Wug divided by the total number of segments (46). Then a binomial test was performed, yielding a 0/1 binary variable denoting successful recognition of the Wug on a given trial. If a child performed significantly above chance (i.e., fixating on the Wug on at least 31 of 46 segments, $p = .03$), we determined that the child successfully recognized the Wug on the trial. Children received two scores, one for target-initial trials and one for distractor-initial trials.

Children's engagement

Children's behaviors in the word-teaching task were coded for four mutually exclusive categories: (a) elicited verbal contributions, (b) spontaneous verbal contributions, (c) elicited nonverbal contributions, and (d) spontaneous nonverbal contributions (see Appendix C for a full description and examples). One fourth (25%) of transcripts were double coded, and inter-rater agreement was 90.19% (Cohen's kappa = .80). We then grouped child contributions into two categories: elicited contributions (verbal and nonverbal) and spontaneous contributions (verbal and nonverbal) and used these sum scores in subsequent analyses.

Results

In the LWL task, there were two types of trial responses: target-initial trials where children fixated on the Wug at word onset and distractor-initial trials where children started on the distractor. The majority of children (89%) had data on target-initial trials ($n = 32$ children; 97 trials), but only 64% of children had data on distractor-initial trials ($n = 23$ children; 41 trials). We selected children's performance on target-initial trials as our outcome measure because it provided a more reliable index of children's word recognition considering that more children provided data on target-initial trials and, on average, children contributed more target-initial trials than distractor-initial trials. Children naturally spent less time looking to the target on distractor-initial trials because they needed to shift to the target rather than remain on the target. The average accuracy scores for these types of trials differed; on average, children spent a larger proportion of time fixating on the Wug during target-initial trials than during distractor-initial trials, $t = 4.12$, $p < .001$. Moreover, individual children very rarely contributed an equal number of target-initial and distractor-initial trials. On average, children contributed 3.03 target-initial trials and 1.78 distractor-initial trials, and this difference was statistically significant, $t = 4.34$, $p < .001$. As a result, averaging across trials could have biased our estimation of children's success in recognizing the novel word. Children with more distractor-initial trials may have lower word recognition scores than those with fewer distractor-initial trials (and thus might be more likely to be scored as not showing word recognition) not because they did not recognize the word but

rather because naturally distractor-initial trials yielded lower accuracy scores. However, as a robustness check, we conducted a difference score analysis using all trials to ensure that our results were not an artifact of the particular outcome we used. The difference score analysis examined changes in children's looking preferences before and after hearing the word "Wug" in the audio stimuli.

Identifying parents' cognitive and autonomy support styles

Descriptive statistics (see Table 3) demonstrated considerable variability in parents' use of cognitive and autonomy support moves. In total, parents produced 1621 Wug-related utterances, constituting 12.36% of all utterances during the interaction (SD = 7.62). We conducted two separate hierarchical cluster analyses (Ward's linkage method with squared Euclidean distances) to identify profiles of parents on two dimensions: cognitive support and autonomy support. The cluster analyses allowed us to take a person-centered approach and simultaneously examine a constellation of parental behaviors. This method grouped parents based on their teaching profiles (i.e., *styles* of combining various teaching moves) rather than their frequency of using individual teaching moves. Given our relatively small sample size (n = 36), using other clustering analysis methods (e.g., *k*-means partitioning) risked forcing groups on potentially homogeneous data. Furthermore, the Ward's linkage method has the advantage of minimizing cluster profile overlap more than other partitioning methods (Milligan & Cooper, 1987).

We ran the cluster analysis twice, first using the frequency of parents' teaching moves and later using the relative proportion of each move out of all Wug-related talk. Cluster membership based on frequency was more strongly associated with children's word recognition and engagement. Furthermore, parents freely distributed time among activities (e.g., book reading, teaching Wug) and used diverse strategies as they would like. Thus, the number of utterances parents devoted to teaching Wug varied greatly (M = 45, SD = 25, range = 7–120). Both the amount of talk devoted to teaching Wug and the makeup of such talk (i.e., how parents combine different teaching moves) were important dimensions of parents' teaching style because they reflect parents' choices and may have contributed to children's learning of the target word. Hence, we report clustering solutions based on frequency. We also examined parents' total amount of talk and proportion of Wug-related talk as individual variables, and neither was associated with children's ability to recognize the Wug whether or not we controlled for child vocabulary knowledge (ps > .05). Controlling for parents' amount of Wug-related talk, the frequency of individual move variables (e.g., the number of times parents asked children to label the

Table 3
Descriptive statistics for parental moves in the word-teaching task.

Type of move	Number of utterances		Proportion out of all parental Wug-related utterances (%)
	Mean SD, [range]	Total	
Cognitive support			
Naming/Acting on the Wug	9.39 5.64, [2, 26]	338	20.85
Providing information about the Wug	9.22 9.26, [0, 42]	332	20.48
Asking the child to name/act on the Wug	12.83 8.35, [2, 34]	462	28.50
Asking the child to provide information about the Wug	5.25 5.73, [0, 21]	189	10.92
Total		1321	81.49
Autonomy support			
Positive evaluation	5.19 4.03, [0, 16]	187	11.54
Follow the child's interest	1.5 1.83, [0, 8]	54	3.33
Redirect the child's attention	0.36 0.99, [0, 5]	13	0.80
Total		254	15.67

Wug) and the number of times parents said the word "Wug" were not associated with children's word recognition ($ps > .05$). Therefore, we found that in this case variation in the sheer amount or proportion of talk or teaching moves did not predict word recognition. However, as we discuss below, the ways that parents used those moves in combination—or the *style* with which they approached the teaching task—appeared to have implications for children's word recognition.

Cognitive support styles

In the first set of analyses, we entered the four cognitive support scores: naming/acting on Wug, asking child to name or act on Wug, providing information about Wug, and asking child to provide information about Wug.

Partitions with two to five clusters were created. We visually inspected the dendrograms and compared cluster solutions on three widely used goodness-of-fit statistics (Cooper & Milligan, 1988; Milligan & Cooper, 1985; for similar procedures, see Leyva & Nolivos, 2015): the cubic clustering criterion (CCC), pseudo-*F* (Caliński & Harabasz, 1974), and the pseudo-t^2 (Duda & Hart, 1973). Comparisons of cluster solutions indicated that a two-cluster solution was optimal (CCC = 4.25, pseudo-t^2 = 4.88, pseudo-*F* = 22.24) with a group of 25 parents (Group 1) and a group of 11 parents (Group 2). We then conducted a quadratic predictive discriminant analysis (PDA) with leave-one-out jackknife reiterations to determine whether the two-cluster partitioning rule reliably predicted cluster membership given the four cognitive support moves (for similar procedures, see Hammett, Van Kleeck, & Huberty, 2003; Leyva & Nolivos, 2015). This analysis yielded an overall correct classification rate of 89% across clusters (96% classification rate for Group 1 and 73% for Group 2). The overall classification rate was higher than that reported in previous research (Hammett et al., 2003). The two-cluster solution resulted in approximately 63.4% fewer errors than partitioning by chance (improvement over chance index; Hammett et al., 2003; Huberty, 1994). Taken together, these analyses indicated that the two-cluster solution was statistically valid and robust. Therefore, we identified two groups of parents representing two distinct cognitive support styles.

Independent-sample *t* tests showed that, on average, there were no differences in parental education or children's vocabulary knowledge between the two groups of parents ($ps > .10$). Parents in Group 1 used more Wug-related utterances than those in Group 2 ($p < .01$). A series of analysis of covariance (ANCOVA) tests indicated that, on average, the two groups of parents were equally likely to label or act on the Wug ($p > .10$), controlling for total number of parental Wug-related utterances and children's vocabulary knowledge. However, parents in Group 1 were significantly more likely to ask children to name, act on, and provide information about the Wug, and to provide children with information about the Wug, than those in Group 2 (all $ps < .001$, $\eta^2 = .004–.10$. Hence, we called parents in Group 1 "Cognitive Scaffolders" because they *combined* a variety of moves (i.e., asking children to label, act on, and provide information about the novel object) and provided information about the novel object beyond labeling it, which may have fostered and enriched children's lexical entry of the novel word. We called them scaffolders because this style presented some degree of challenge to toddlers, and in doing so it might go beyond children's current level of ability (Vygotsky, 1978). In contrast, parents in Group 2 were called "Labelers" because they tended to focus on labeling the novel object themselves. Compared with parents who were Labelers, parents who were Cognitive Scaffolders were more diverse in their teaching moves and, hence, provided a higher level of cognitive support.

Autonomy support styles

We followed the same clustering analysis procedure and entered the three autonomy supportive scores: positive evaluation, following the child's interest, and redirecting the child's attention. The analysis indicated that a two-cluster solution was optimal (CCC = 3.70, pseudo-t^2 = 23.71, pseudo-*F* = 55.62). The two groups consisted of 7 parents (Group 1) and 29 parents (Group 2). A quadratic PDA (after Box's *M* test showing heterogeneity) with leave-one-out jackknife reiterations generated an overall correct classification rate of 100% across clusters despite changes in random seeds. This indicated that the two-cluster partitioning rule reliably predicted cluster membership given the three autonomy support moves. Partitioning the observations into two groups by chance resulted in a substantively lower correct classification rate of 72.22%. Based on these statistical measures, the

two-cluster solution was statistically valid and stable. Hence, we partitioned parents into two groups representing two different styles of autonomy support.

t Tests indicated that, on average, the two groups of parents did not differ in parental education, children's vocabulary knowledge, or total number of parental Wug-related utterances ($ps > .05$). ANCOVA tests showed that, controlling for the total number of parental Wug-related utterances and children's vocabulary knowledge, the two groups of parents were equally likely to redirect children's attention ($p > .10$). Compared with parents in Group 2, those in Group 1 were significantly more likely to follow children's interests and attention and to provide positive evaluations (all $ps < .05$, $\eta^2 s = .17–.44$. Hence, we called parents in Group 1 "Followers" because they more actively followed children's attention and interest and provided more affirmations. In contrast, parents in Group 2 were called "Non-followers" because they used moves of following, affirming, and redirecting in a more balanced manner. Thus, parents who were Followers showed a higher level of autonomy support, whereas parents who were Non-followers were moderate in autonomy support.

In addition, 4 parents were Cognitive Scaffolders and Followers (high in cognitive support and high in autonomy support), 22 parents were Labelers and Non-followers (low in cognitive support and moderate in autonomy support), 7 parents were Cognitive Scaffolders and Non-followers (high in cognitive support and moderate in autonomy support), and 3 parents were Labelers and Followers (low in cognitive support and high in autonomy support). A Fisher's exact test of independence yielded no significant associations between parents' cognitive support styles (Cognitive Scaffolders vs. Labelers) and autonomy support styles (Followers vs. Non-followers) ($p > .10$). Hence, cognitive support and autonomy support styles were relatively independent.

Relation between parents' styles and children's word recognition

To address our second research question concerning links between parents' styles and children's word recognition, we conducted a series of mixed-effects logistic regressions using R-Studio software, with trial responses nested within children. The predictors were parents' cognitive and autonomy support styles in the word-teaching task (coded as dummy variables), and the outcome was whether the child successfully recognized the Wug (binary variable based on proportion accuracy in the LWL task). We controlled for child vocabulary knowledge (CDI raw score). Child age was not included because preliminary analysis showed that it was not significantly related to predictors or the outcome. Because parents' total amount or proportion of Wug-related talk was not associated with children's ability to recognize the Wug, it was not included as a covariate in analyses predicting children's word recognition from parental style.

Results of mixed-effects logistic regressions are presented in Table 4. In Model 1, we entered parents' cognitive scaffolding style (Cognitive Scaffolders) and the covariate (children's vocabulary knowledge). The dependent measure was a 0/1 binary variable denoting successful recognition of the Wug on each target-initial trial. The model showed that children of Cognitive Scaffolders were more likely to recognize the Wug, $B = 1.15$, 95% confidence interval (CI) [0.17, 2.25], odds ratio (*OR*) = 3.16. That is, controlling for children's vocabulary knowledge, the odds of recognizing the Wug for children of Cognitive Scaffolders were 3.16 times those for children of Labeler parents. In Model 2, we added parents' autonomy support style (Followers) and found that children of Cognitive Scaffolders were still more likely recognize the Wug than those of Labelers, $B = 1.16$, *OR* = 3.19, 95% CI [0.11, 2.35], $p < .05$, whereas children of Followers were not more likely to recognize the Wug than those of Non-followers, $B = −0.051$, *OR* = 0.95, 95% CI [−1.31, 1.23], $p > .50$. Hence, controlling for parental autonomy support style and children's vocabulary knowledge, the odds of recognizing the Wug for children with Cognitive Scaffolder parents were 3.19 times those for children with Labeler parents (proportion of correct trials was 81.82% vs. 59.38%, respectively). Children who had larger vocabularies were not more likely to recognize the Wug. And, controlling for children's CDI scores, children of Followers were not more likely to recognize the Wug than those of Non-followers, $B = 0.069$, *OR* = 1.07, 95% CI [−1.00, 1.22], $p > .50$.

One critical question is whether children of Cognitive Scaffolders simply showed greater preference for the Wug image. After all, children were more familiar with the Wug than with the distractor. It is

Table 4

Results of mixed-effects logistic regressions examining the relation between parents' styles and children's word recognition.

	Model 1 $N_{children}$ = 32 N_{trials} = 97	Model 2 $N_{children}$ = 32 N_{trials} = 97
Predictors		
Cognitive Scaffolder style	1.15[*] (0.52)	1.16[*] (0.56)
Follower style	–	−0.50 (0.57)
Covariate		
Child vocabulary knowledge (CDI)	−0.012 (0.01)	−0.011 (0.01)
Intercept	0.93 (0.44)	0.92 (0.46)
Fit statistics		
Log likelihood	−57.64	−57.632
Akaike information criterion	123.27	125.27
Bayesian information criterion	133.57	138.14

Note. Unstandardized betas are displayed (with standard errors in parentheses).
[*] $p < .05$.

also possible that the Wug, with bigger eyes, was visually more salient than the distractor. If the group differences in looking pattern were solely due to the fact that children of Cognitive Scaffolders showed stronger baseline preference for the Wug, children of Cognitive Scaffolders should fixate longer on the Wug, whether or not they were instructed to look, even prior to hearing the word "Wug" in the audio instructions ("Where is/Look at the Wug") than children of Labelers.

To address this possibility, two reliable coders coded 300–1800 ms *before* the "Wug" word onset (henceforth pre-naming coding window) (proportions of agreement > 97%). The mean proportions of time that children looked to the Wug and the distractor in target-initial trials are reported in Fig. 1. Mixed-effects logistic regression models showed that during the pre-naming window, children of Cognitive Scaffolders were not more likely to fixate on the Wug than children of Labelers, $B = 0.27$, 95% $OR = 1.31$, CI $[−0.65, 1.26]$, $p > .50$. After adding children's vocabulary knowledge (scaled for model convergence), parents' cognitive support style was still not related to children's likelihood of fixating on the Wug, $B = 0.26$, $OR = 1.30$, 95% CI $[−0.60, 1.22]$, $p > .50$. Hence, compared with children
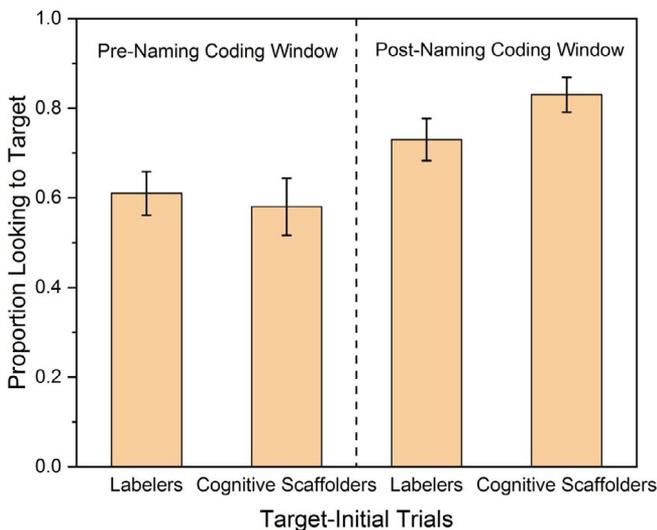

Fig. 1. Children's mean proportion of time looking to the target (Wug) during each coding window on target-initial trials. The means and standard errors were estimated using mixed-effects models with trials nested within children.

of Labelers, children of Cognitive Scaffolders did not show stronger preferences for the Wug before the word onset. In contrast, during the post-naming period, children of Cognitive Scaffolders were significantly more likely to fixate on the Wug.

We also conducted a difference score analysis to examine changes in children's looking patterns before and after hearing "Wug" in the audio stimuli. We calculated a difference score for each trial as children's proportion of time looking to the Wug in the post-naming window subtracted from that in the pre-naming window. We included all target-initial and distractor-initial trials in this analysis because whether a trial was target initial or distractor initial should not affect the difference score. Children's mean difference scores are reported in Fig. 2. A two-sample t test did not show significant differences in mean difference scores between groups, $t = 1.12$, $p > .10$. However, a one-sample t test comparing mean difference scores with 0 showed that children of Cognitive Scaffolders had a positive mean difference score, $t = 2.30$, $p < .05$, whereas children of Labelers had a mean difference score that was not significantly greater than zero, $t = 1.64$, $p > .05$. Hence, adjusting for children's baseline looking preferences during the pre-naming coding window, children of Cognitive Scaffolders showed successful word recognition by shifting their gazes toward the Wug upon hearing "Wug", whereas children of Labelers did not. Hence, on both measures (Wug recognition measure and difference score measure), children of Cognitive Scaffolders showed greater success in word recognition than children of Labelers.

Relation between parents' styles and children's engagement

Descriptive statistics for children's contributions are reported in Table 5. Children's elicited and spontaneous contributions were positively related ($r = .60$, $p < .001$). Children's elicited and
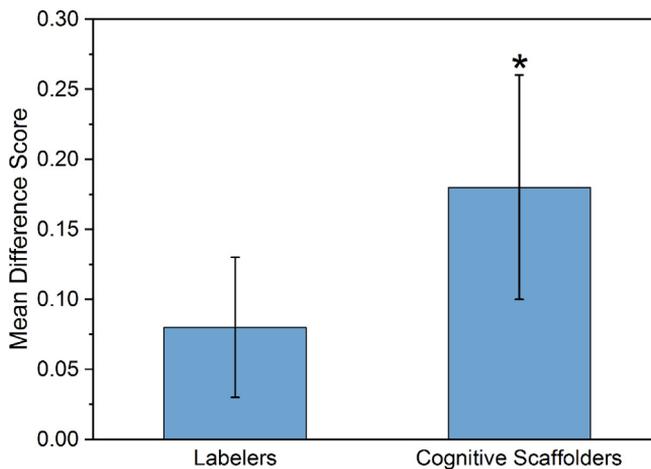

Fig. 2. Children's mean difference scores by group. The means and standard errors were estimated using a mixed-effects model with trials nested within children. Note: *p < .05.

Table 5
Descriptive statistics for children's engagement in the word-teaching task.

Type of contribution	Number of utterances	
	Mean SD, [range]	Total
Elicited contributions	10.42 8.81, [0, 36]	375
Spontaneous contributions	1.31 2.21, [0, 10]	47
Total		422

Table 6

Results of ordinary least-squares regression analysis examining the relation between parents' styles and children's engagement in the word-teaching task.

	Model 1 (only predictors) N = 36		Model 2 (predictors + covariates) N = 36	
	Elicited contributions	Spontaneous contributions	Elicited contributions	Spontaneous contributions
Predictors				
Cognitive Scaffolder style	5.17[*] (2.40)	1.96[**] (0.68)	1.85 (3.34)	1.84 (0.98)
Follower style	12.85[***] (2.79)	1.99[*] (0.79)	11.14[***] (2.88)	1.73[*] (0.84)
Covariates				
Child vocabulary knowledge (CDI)	–	–	0.05 (0.04)	0.01 (0.01)
Amount of Wug-related talk	–	–	0.11 (0.07)	0.01 (0.02)
Intercept	6.34[***] (1.32)	0.32 (0.37)	1.11 (3.03)	−0.33 (0.88)
Fit statistics				
Adjusted R^2	.48	.35	.50	.33
Residual standard error	6.36	1.79	6.21	1.82

Note. Unstandardized betas are displayed (with standard errors in parentheses).

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

spontaneous contributions were not correlated with their vocabulary knowledge ($ps > .10$). Table 6 shows the results of ordinary least-squares (OLS) regressions examining the relation between parents' styles and children's elicited and spontaneous contributions. In Model 1, we entered the predictors (parents' styles) and found that both Cognitive Scaffolders and Followers were positively related to children's elicited and spontaneous contributions. In Model 2, we added the covariates (child vocabulary knowledge and total number of parental Wug-related utterances) in order to control for children's vocabulary knowledge and the total amount of communicative exchange in which children participated. We found that Followers, but not Cognitive Scaffolders, remained positively associated with children's elicited and spontaneous contributions over and above covariates.

Relations between children's word recognition and engagement

We conducted mixed-effects logistic regressions testing the relations between children's contributions in the word-teaching task and their success at Wug recognition (binary variable). The covariates were child vocabulary knowledge and the total number of parental Wug-related utterances. These analyses yielded no significant associations between children's elicited and spontaneous contributions and their ability to recognize the Wug, $Bs = 0.035$ and 0.11, $ORs = 1.04$ and 1.17, 95% CIs $[−0.050, 0.12]$ and $[−0.15, 0.42]$, respectively, $ps > .10$. Nor were children's overall contributions (i.e., elicited and spontaneous contributions taken together) significantly associated with children's word recognition, $B = 0.032$, $OR = 1.03$, 95% CI $[−0.039, 0.11]$, $p > .10$, controlling for children's size of vocabulary and the number of parental Wug-related utterances.

Discussion

The primary contribution of this study is that our findings highlight parental teaching *styles* that differentially contribute to toddlers' word recognition and engagement in a word-learning task. Specifically, parental cognitive support styles related to children's ability to recognize and process the novel word, and parental autonomy support styles related to children's engagement in the word-teaching task—their elicited and spontaneous contributions. Children's word recognition did not relate to engagement. Below we elaborate on these findings.

We identified two styles of parental cognitive support: Cognitive Scaffolders and Labelers. Compared with parents who adopted a Labeler style, those who were Cognitive Scaffolders were more likely to use three cognitive supports—asking the child to label or act on the novel object, providing information about the novel object, and asking the child to provide information about the novel object—and, hence, *combined* a larger diversity of cognitive supports. In contrast, parents who were Labelers tended to focus on one cognitive support: labeling the novel object. This distinction is central because it reflects one of the main advantages of using a person-centered approach to studying how parents support children's word recognition. The patterns identified in this study reflected different *combinations* of parental cognitive supports rather than variation in the extent to which parents used isolated cognitive supports. We also identified two styles of parental autonomy support: Followers and Non-followers. Parents who adopted the Follower style were more likely to follow the child's interest and attention and to provide positive evaluations. In contrast, parents who were Non-Followers used a balance of different supports rather than focusing on a particular one such as following the child's interest.

Importantly, there were no associations between parental cognitive support and autonomy support styles. It was not the case that parents who adopted one particular cognitive support style were more likely to adopt a particular autonomy support style. Thus, cognitive support and autonomy support emerged as separate dimensions of parenting relating to word recognition and engagement in unique ways. These results aligned with prior research on memory development in toddlers and preschoolers, showing independence of these two parenting dimensions (Cleveland & Reese, 2005; Leyva et al., 2009) and suggesting that the distinction between cognitive support and autonomy support styles is valid across domains.

Children whose parents adopted a Cognitive Scaffolder style were more likely to recognize the word they were taught than children whose parents adopted the Labeler style, controlling for child vocabulary knowledge. Moreover, a difference score analysis showed that, adjusting for children's baseline looking preferences, children of Cognitive Scaffolders shifted their gaze to the Wug after hearing the word "Wug," whereas children of Labelers did not. Whether parents adopted a Cognitive Scaffolder or Labeler style bore no relation to children's engagement, that is, their elicited and spontaneous contributions in the word-teaching task. In contrast, children whose parents adopted a Follower style were more engaged in the word-teaching task, as reflected by their elicited and spontaneous contributions, than children whose parents were Non-followers. However, parents who were Followers did not have children who were better at recognizing the target word.

These differential associations have been previously found in children's memory development. Studies have shown that maternal cognitive support is positively associated with children's autobiographical memory abilities and that maternal autonomy support is related to children's engagement in independent reminiscing tasks (Cleveland et al., 2007; Leyva et al., 2009). Echoing these findings, the current study is the first to establish how parental cognitive and autonomy support styles are independently and differentially associated with children's word recognition. Critically, in the current study, parents' variability in the use of individual cognitive supports (e.g., asking children to label the Wug) was not associated with children's word recognition. Rather, it was the style in which parents naturally *combined* all four cognitive moves that related to children's Wug recognition. In Reese and Cox (1999), parents who were taught to adopt a describer style, focusing on labeling and describing pictures during book reading, had preschoolers with larger receptive vocabulary than parents who were taught to use other styles such as asking inferential questions and providing positive feedback. In our study, we categorized "labeling" and "asking the child to label or act on the Wug" as different moves and found that whereas focusing primarily on labeling did not relate to word recognition (i.e., Labeler style), focusing on labeling along with asking the child to label and provide information about the novel word as well as providing rich information to the child, as the Cognitive Scaffolders did, related to children's word recognition. Taken together, these findings highlight that combining a diversity of cognitive scaffolding moves may be particularly effective in scaffolding children's word recognition.

Why is a Cognitive Scaffolder teaching style positively associated with children's word recognition? The current study does not shed light on the mechanisms, but mechanisms can be hypothesized based on extant literature on children's word learning. Children learn words by drawing on various social

and contextual cues (Echols & Marti, 2004; Tomasello & Barton, 1994). The availability and richness of such cues are closely associated with word learning efficiency (Cartmill et al., 2013). In the current study, parents who were Cognitive Scaffolders naturally combined diverse moves to provide and elicit information about the novel word. As parents elicited labels from children and encouraged children to act on the novel object, they may have helped children to establish, rehearse, and strengthen the mapping between the novel label and the corresponding referent. Moreover, through providing information about the novel word, parents may have used words in various syntactic and semantic contexts, helped children to reinforce and enrich the newly established lexical entry, and directed children's attention to information that is helpful for recognizing the target object such as shape and color.

Parents classified as Followers, on the other hand, followed children's initiatives and frequently issued affirmations potentially to encourage children's attempts at exploration and learning. Such following in and affirmations may have encouraged children to take a more active part in the communicative exchanges. Hence, children whose parents adopted a Follower style not only were more responsive to parents' elicitations but also made more spontaneous contributions during the interaction.

We were surprised that children's engagement was not associated with their success in recognizing the taught word. The lack of association may be because we measured children's recognition of only one word in a relatively short time frame. Children's engagement and their parents' ability to foster it may be important predictors of word learning over longer periods of time and when multiple words are taught. Moreover, we focused on children's behavioral engagement. Other types of engagement, such as children's emotional engagement (i.e., affective ties, emotional connections, attitudes toward learning) might be more closely related to their word recognition (Downer et al., 2007; Fredricks et al., 2004). Furthermore, we assessed children's engagement in a joint task (word-teaching task). Prior research has found relations between parental autonomy support in a joint task and children's engagement in a subsequent independent task (Cleveland et al., 2007). In the future, it might be important to include a measure of children's independent engagement to further understand the role that children's engagement plays in learning situations.

We did not find associations between children's vocabulary knowledge and their word recognition over and above parental teaching styles. This was somewhat surprising. However, not all studies exploring the relations between children's vocabulary knowledge and word learning find associations between them. For instance, Lucca and Wilbourn (2018) did not find links between 18-month-olds' size of vocabulary and fast mapping efficiency. Studies showing associations between children's size of vocabulary and their lexical processing efficiency as measured with the LWL paradigm typically tested children with familiar words (Fernald et al., 2013), were conducted with children over 2 years of age (Bion et al., 2013; Law & Edwards, 2015), and involved families of diverse socioeconomic status (Fernald et al., 2013), thereby potentially increasing variation. Our finding of no relation is similar to Lucca and Wilbourn (2018) with a more homogeneous sample of younger toddlers. However, future research should continue to explore this question with different paradigms at different child ages.

One may argue that this lack of association could suggest that the word-teaching task was too easy for children. However, our difference score analysis suggested otherwise. Children of Cognitive Scaffolders, on average, shifted their gaze to the Wug after hearing the word "Wug" on LWL trials, whereas children of Labelers did not demonstrate evidence for recognition (i.e., a positive shift to the Wug).

Limitations and future directions

The sample size in the current study was relatively small. In addition, children in the study were from homes where the parents had at least some college education. Thus, whether our findings are generalizable to other populations, such as families from other socioeconomic groups, is a question that needs to be addressed by future research. The tasks used in this study (word teaching and LWL) involved a single novel noun. It is open to question what children learned about the word (e.g., they might recognize the Wug object when they heard the word "Wug," but they might not remember that a Wug has blue eyes) or how robust children's learning was (e.g., whether children were able to recognize a Wug after a delay). Whether the results would generalize to other nouns and other word types such as action verbs also requires empirical examination. Moreover, in future

studies, it would be important to control for the visual attractiveness of the stimuli (e.g., by including a condition where the image associated with the taught word was balanced). Furthermore, the word-teaching task is an approximation of true teaching in everyday contexts. An issue that should be further investigated is whether in more naturalistic contexts, parents adopt similar cognitive and autonomy supportive styles.

In sum, this study contributes to prior research by showing that although variable-centered approaches to identifying predictors of word learning are certainly useful, it might not be simply whether parents use more or less of one type of support or another but also the combination of supports that matter for children's word recognition. This finding is relevant to researchers who are trying to identify the features of parent input that promote learning. In the current study, combining a larger diversity of moves seemed to be positively associated with children's learning. Thus, these findings can also have implications for interventions with parents. Rather than promoting the use of a single type of support, programs could emphasize the importance of using them in combination and what types of combinations are useful to promote learning.

Acknowledgments

Appendix A

Wug stimulus used in the word-teaching task

Appendix B

Stimuli used in the Looking-While-Listening task (Wug–distractor trials)

Appendix C

Coding scheme of children's contributions in the word-teaching task

Type of move	Definition	Examples
Elicited verbal contribution	Responds to parent's statements or requests with a verbal statement or request	Parent: "Can you say 'Wug'?" Child:"Wug."
Elicited nonverbal contribution	Responds to parent's statements or requests with a nonverbal communicative action or gesture	Parent: "Can you tickle Wug?" [Child tickles the Wug.]
Spontaneous verbal contribution	Provides spontaneous information or makes spontaneous requests to parent	Parent: "Can you say 'Wug'?" Child: "Can I see it?"
Spontaneous nonverbal contribution	Engages in spontaneous actions that are information seeking (e.g., pointing) or communicating some information to the parent	Parent: "Funny Wug." [Child points to the Wug's eye.]

References

Akhtar, N., Jipson, J., & Callanan, M. A. (2001). Learning words through overhearing. *Child Development, 72*, 416–430.
Ard, L. M., & Beverly, B. L. (2004). Preschool word learning during joint book reading: Effect of adult questions and comments. *Communication Disorders Quarterly, 26*, 17–28.
Axelsson, E. L., & Horst, J. S. (2013). Testing a word is not a test of word learning. *Acta Psychologica, 144*, 264–268.

Bergelson, E., & Swingley, D. (2013). The acquisition of abstract words by young infants. *Cognition, 127*, 391–397.

Bergman, L. R., Magnusson, D., & El Khouri, B. (2003). *Studying individual development in an interindividual context: A person-oriented approach.* Mahwah, NJ: Lawrence Erlbaum.

Bernier, A., Carlson, S. M., & Whipple, N. (2010). From external regulation to self-regulation: Early parenting precursors of young children's executive functioning. *Child Development, 81*, 326–339.

Bibok, M. B., Carpendale, J. I. M., & Müller, U. (2009). Parental scaffolding and the development of executive function. *New Directions in Child and Adolescent Development, 123*, 17–34.

Bion, R. A. H., Borovsky, A., & Fernald, A. (2013). Fast mapping, slow learning: Disambiguation of novel word–object mappings in relation to vocabulary learning at 18, 24, and 30 months. *Cognition, 126*, 39–53.

Blewitt, P., & Langan, R. (2016). Learning words during shared book reading: The role of extratextual talk designed to increase child engagement. *Journal of Experimental Child Psychology, 150*, 404–410.

Blewitt, P., Rump, K. M., Shealy, S. E., & Cook, S. A. (2009). Shared book reading: When and how questions affect young children's word learning. *Journal of Educational Psychology, 101*, 294–304.

Boersma, P. (2001). Praat, a system for doing phonetics by computer. *Glot International, 5*, 341–345.

Bus, A. G., van IJzendoorn, M. H., & Pellegrini, A. D. (1995). Joint book reading makes for success in learning to read: A meta-analysis on intergenerational transmission of literacy. *Review of Educational Research, 65*, 1–21.

Caliński, T., & Harabasz, J. (1974). A dendrite method for cluster analysis. *Communications in Statistics—Theory and Methods, 3*(1), 1–27.

Cartmill, E. A., Armstrong, B. F., Gleitman, L. R., Goldin-Meadow, S., Medina, T. N., & Trueswell, J. C. (2013). Quality of early parent input predicts child vocabulary 3 years later. *Proceedings of the National Academy of Sciences of the United States of America, 110*, 11278–11283.

Cleveland, E. S., & Reese, E. (2005). Maternal structure and autonomy support in conversations about the past: Contributions to children's autobiographical memory. *Developmental Psychology, 41*, 376–388.

Cleveland, E. S., Reese, E., & Grolnick, W. S. (2007). Children's engagement and competence in personal recollection: Effects of parents' reminiscing goals. *Journal of Experimental Child Psychology, 96*, 131–149.

Cooper, M. C., & Milligan, G. W. (1988). The effect of measurement error on determining the number of clusters in cluster analysis. In W. A. Gaul & M. Schader (Eds.), *Data, expert knowledge and decisions* (pp. 319–328). Medford, MA: Springer.

Deci, E. L., & Ryan, R. M. (1987). The support of autonomy and the control of behavior. *Journal of Personality and Social Psychology, 53*, 1024–1037.

Downer, J. T., Rimm-Kaufman, S. E., & Pianta, R. C. (2007). How do classroom conditions and children's risk for school problems contribute to children's behavioral engagement in learning? *School Psychology Review, 36*, 413–432.

Duda, R. O., & Hart, P. E. (1973). *Pattern classification and scene analysis.* New York: John Wiley.

Echols, C. H., & Marti, C. N. (2004). The identification of words and their meanings: From perceptual biases to language specific cues. In D. G. Hall & S. R. Waxman (Eds.), *Weaving a lexicon* (pp. 41–78). Cambridge, MA: MIT Press.

Ewers, C. A., & Brownson, S. M. (1999). Kindergarteners' vocabulary acquisition as a function of active vs. passive storybook reading, prior vocabulary, and working memory. *Reading Psychology, 20*, 11–20.

Fenson, L., Marchman, V. A., Thal, D. J., Dale, P. S., Reznick, J. S., & Bates, E. (2007). *MacArthur–Bates Communicative Development Inventories: User's guide and technical manual* (2nd ed.). Baltimore, MD: Brookes.

Fernald, A., & Marchman, V. A. (2012). Individual differences in lexical processing at 18 months predict vocabulary growth in typically developing and late-talking toddlers. *Child Development, 83*, 203–222.

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

Fernald, A., Zangl, R., Portillo, A. L., & Marchman, V. (2008). Looking while listening: Using eye movements to monitor spoken language comprehension by infants and young children. In I. A. Sekerina, E. M. Fernandez, & H. Clahsen (Eds.), *Developmental psycholinguistics: On-line methods in children's language processing* (pp. 97–135). Amsterdam: John Benjamins.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*, 59–109.

Grolnick, W. S., Gurland, S. T., DeCourcey, W., & Jacob, K. (2002). Antecedents and consequences of mothers' autonomy support: An experimental investigation. *Developmental Psychology, 38*, 143–155.

Grolnick, W. S., & Pomerantz, E. M. (2009). Issues and challenges in studying parental control: Toward a new conceptualization. *Child Development Perspectives, 3*, 165–170.

Haden, C. A., Reese, E., & Fivush, R. (1996). Mothers' extratextual comments during storybook reading: Stylistic differences over time and across texts. *Discourse Processes, 21*, 135–169.

Hammett, L., Van Kleeck, A., & Huberty, C. (2003). Clusters of parent interaction behaviors during book sharing with preschoolers: Dispelling the myth about middle-income parents' book-sharing strategies. *Reading Research Quarterly, 38*, 2–29.

Hammond, J. (Ed.). (2002). *Scaffolding teaching and learning in language and literacy education.* Newtown, Australia: Primary English Teaching Association.

Hindman, A. H., & Morrison, F. J. (2012). Differential contributions of three parenting dimensions to preschool literacy and social skills in a middle-income sample. *Merrill-Palmer Quarterly, 58*, 191–223.

Huberty, C. J. (1994). *Applied discriminant analysis.* New York: John Wiley.

Hurtado, N., Marchman, V., & Fernald, A. (2007). Spoken word recognition by Latino children learning Spanish as their first language. *Journal of Child Language, 34*, 227–249.

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

Law, F., & Edwards, J. R. (2015). Effects of Vocabulary Size on Online Lexical Processing by Preschoolers. *Language Learning and Development, 11*(4), 331–355. https://doi.org/10.1080/15475441.2014.961066.

Justice, L. M., Meier, J., & Walpole, S. (2005). Learning new words from storybooks: An efficacy study with at-risk kindergarteners. *Language, Speech, and Hearing Services in Schools, 36*, 17–32.

Leyva, D., & Nolivos, V. (2015). Chilean family reminiscing about emotions and its relation to children's self-regulation skills. *Early Education and Development, 26*, 770–791.

Leyva, D., Reese, E., Grolnick, W., & Price, C. (2009). Elaboration and autonomy support in low-income mothers' reminiscing: Links to children's autobiographical narratives. *Journal of Cognition and Development, 9*, 363–389.

Lucca, K., & Wilbourn, M. P. (2018). Communicating to learn: Infants' pointing gestures result in optimal learning. *Child Development, 89*, 941–960.

MacWhinney, B. (2000). *The CHILDES project: Tools for analyzing talk* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum.

Malin, J. L., Cabrera, N. J., & Rowe, M. L. (2014). Low-income minority mothers' and fathers' reading and children's interest: Longitudinal contributions to children's receptive vocabulary skills. *Early Childhood Research Quarterly, 29*, 425–432.

Matte-Gagné, C., Harvey, B., Stack, D. M., & Serbin, L. A. (2015). Contextual specificity in the relationship between maternal autonomy support and children's socio-emotional development: A longitudinal study from preschool to preadolescence. *Journal of Youth & Adolescence, 44*, 1528–1541.

Milligan, G. W., & Cooper, M. C. (1985). An examination of procedures for determining the number of clusters in a data set. *Psychometrika, 50*, 159–179.

Milligan, G. W., & Cooper, M. C. (1987). Methodology review: Clustering methods. *Applied Psychological Measurement, 11*, 329–354.

Naigles, L. R., & Hoff-Ginsberg, E. (1998). Why are some verbs learned before other verbs? Effects of input frequency and structure on children's early verb use. *Journal of Child Language, 25*, 95–120.

Pan, B. A., Rowe, M. L., Singer, J. D., & Snow, C. E. (2005). Maternal correlates of growth in toddler vocabulary production in low-income families. *Child Development, 76*, 763–782.

Reese, E., & Cox, A. (1999). Quality of adult book reading affects children's emergent literacy. *Developmental Psychology, 35*, 20–28.

Roberts, J., Jergens, J., & Burchinal, M. (2005). The role of home literacy practices in preschool children's language and emergent literacy skills. *Journal of Speech, Language, and Hearing Research, 48*, 345–359.

Rowe, M. L. (2012). Recording, transcribing, and coding interaction. In E. Hoff (Ed.), *Research methods in child language: A practical guide* (pp. 191–207). Hoboken, NJ: Blackwell.

Sénéchal, M. (1997). The differential effect of storybook reading on preschoolers' acquisition of expressive and receptive vocabulary. *Journal of Child Language, 24*, 123–138.

Sénéchal, M., Thomas, E., & Monker, J.-A. (1995). Individual differences in 4-year-old children's acquisition of vocabulary during storybook reading. *Journal of Educational Psychology, 87*, 218–229.

Tamis-LeMonda, C., Sze, I., Ng, F., Kahana-Kalman, R., & Yoshikawa, H. (2013). Maternal teaching during play with four-year-olds: Variation by ethnicity and family resources. *Merrill-Palmer Quarterly, 59*, 361–398.

Tomasello, M., & Barton, M. E. (1994). Learning words in nonostensive contexts. *Developmental Psychology, 30*, 639–650.

Tomasello, M., & Farrar, M. J. (1986). Joint attention and early language. *Child Development, 57*, 1454–1463.

Tomasello, M., & Merriman, W. E. (Eds.). (1995). *Beyond names for things: Young children's acquisition of verbs*. Hillsdale, NJ: Lawrence Erlbaum.

Tomasello, M., & Todd, J. (1983). Joint attention and lexical acquisition style. *First Language, 4*, 197–211.

Vygotsky, L. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.