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Language Production in Children with and at Risk for Delay: Mediating Role of Parenting Skills

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Abstract

Objective—The current study examined the effect of Parent-Child Interaction Therapy (PCIT), a parent-training intervention for child behavior problems, on child language production.

Method—Participants were 46 children (ages 20-70 months) with externalizing behavior problems and with or at risk for developmental delay. Parent-child dyads were randomly assigned to a waitlist control or immediate treatment group. Parenting skills learned during PCIT (i.e., “do skills”) and children's word tokens and word types were measured at baseline and 4 months later.

Results—Findings suggest an indirect effect of parent do skills on the relation between group and child word types, such that more parent do skills predicted more child word types for families receiving PCIT.

Conclusions—The present study found that mothers’ use of child-directed skills played an important role in the growth and improvement of child language. Results suggest parent-training interventions targeting child behavior problems may also foster child language production.

Keywords

parent training; Parent-Child Interaction Therapy; language production; behavior problems; developmental delay

Language acquisition in early childhood is a dynamic process and provides an important foundation for subsequent language and literacy skills (McCoy, 2008). Typically developing children tend to acquire many of the necessary language components by 3 years. However, children with developmental delay display a variety of difficulties in communication, including problems conversing, initiating interactions, and using multiword utterances (e.g., Marfo, 1984; Yoder, Spruytenburg, Edwards, & Davies, 1995). These delayed early language milestones can have significant consequences on a child's developmental trajectory (Ronski et al., 2010), including behavior problems and poor academic outcomes (Baker & Cantwell, 1987), as well as language and literacy difficulties later in life (e.g., Preston et al., 2010).

Behavior Problems and Language Difficulties

Behavior problems, in particular, are common in children with developmental delay (Dekker, Koot, van der Ende, & Verhulst, 2002). Research has found significantly higher rates of emotional and behavioral difficulties among two to three year-old children with developmental delay (Emerson & Einfeld, 2010). Specifically, findings suggest that three-year-old children with developmental delay are three to four times as likely to have a total CBCL score within the clinical range than their non-delayed peers (Baker, Blacher, Crnic, Edelbrock, 2002). The increased prevalence of behavior problems in children with developmental delay may be due, in part, to the child's difficulty in communication. For example, young children with language difficulties and or language delays may display aggressive behavior due to frustration with communication or lack of social-cognitive skills (Baker & Cantwell, 1983; Crowley, 1992). A recent review revealed that 71% of children diagnosed with an emotional or behavioral disorder displayed significant language deficits, and over half (57%) of the children diagnosed with language deficits also were diagnosed with an emotional or behavioral disorder (Benner, Nelson, & Epstein, 2002). These findings highlight a potential bidirectional relation between behavior problems and language difficulties, suggesting the need for interventions that can impact both problems simultaneously (Van Daal, Verhoeven, & Van Balkom, 2007). If left untreated, behavior problems may exacerbate language difficulties (Rutter & Lord, 1987), which also can impede speech and gains from speech therapy (Baker & Cantwell, 1987). Alternatively, language difficulties may have a negative impact on behavior, resulting in increased rates of inattentiveness, aggression, or social withdrawal (Tempel, Wagner, and McNeil, 2008). Given the proposed bidirectional relation between behavior problems and language difficulties, it is important to consider shared etiological influences as a potential target for intervention, such as parent-child interactions (Hart & Risley, 1995).

Parent-Child Interactions

Both child language difficulties and behavior problems are associated with the type and quality of parent-child interactions, especially among children with development delay (Campbell, 1995). For example, parents who are less responsive have difficulty providing a language-rich environment for their children (Delane & Kaiser, 2001). Frequent use of directive and corrective statements (e.g., commands, criticisms) are associated with delays in children's language abilities (e.g., Barnes, Gutfreund, Satterly, & Wells, 1983; Hart & Risley, 1995; Vibbert & Bornstein, 1989). In fact, language development is enhanced when parents engage in a conversational and child-directed speech style (e.g., commenting on the child's actions and focus of attention; Chapman, 2000; Hart & Risley, 1995). On the other hand, there is evidence that supportive directive acts (e.g., parental control which follows the child's goal) predict better social skills for children with developmental delay. However, mothers of children with developmental delay typically use more interfering than supportive directives, and more interfering directives predict lower adaptive and social skills for children with developmental delay (Green, Caplan, Baker, 2013). Overall, evidence suggests the use of nondirective play and following the child's lead may help to improve language skills in children with developmental delay (Koegel, Koegel, & Surratt, 1992).

Furthermore, the quality of the parent-child interaction is associated with child behavior (e.g., Campbell, 1995; McMahon, Long, & Forehand, 2011). A model by Crnic, Hoffman, Gaze, & Edelbrock (2004) suggests that the presence of early developmental delay is strongly associated with family climate and parent-child relationships, which in turn influences children's self-regulatory behavior and the emergence of behavior problems. Although family functioning and parent-child interactions do not completely account for children's problematic outcomes, they represent important factors that can be targeted in treatment, especially for children with or at-risk for developmental delay (Crnic, Hoffman, Gaze, & Edelbrock, 2004).

The Role of Parents in Treatment

Given the role of parent-child interactions in the development of both behavioral and language difficulties, parent-child interactions are an important target for treatment (Delane & Kaiser, 2001). Teaching parents to be child-centered in their interactions has yielded a significant, positive influence on receptive and expressive language skills among children with and without intellectual disabilities (e.g., Roberts & Kaiser, 2011). Similarly, promoting child-centered play in parent training can be effective in reducing early childhood behavior problems (Eyberg, Nelson, & Boggs, 2008; Kaminski, Valle, Filene, & Boyle, 2008; Webster-Stratton, Reid, & Hammond, 2004). Many of these child-centered language and behavioral parent-training interventions share components, such as home activities, following the child's lead, and adult contingent social responsiveness (Dunst, Raab, & Trivette, 2011). In the present study, we targeted parent-child interactions because evidence suggests encouraging more parental responsiveness and less directiveness increases opportunities for the child to interact more positively and develop enhanced language skills (e.g., Tannock, Girolametto, & Siegel, 1992).

Targeting Behavior and Language Simultaneously

Despite the common elements of child-centered language and behavioral parent-training interventions (e.g., home activities, following child's lead, etc.), most interventions do not target both child language difficulties and child behavior problems simultaneously. However, some studies examining interventions aimed at targeting child behavior problems also have found intervention effects on child language (Bierman et al., 2008; Brennan et al., 2012; Lunkenheimer et al., 2008). For instance, the Family Check-Up (FCU), a brief motivational intervention for toddlers at risk for problem behaviors, was examined in a mediational model testing the indirect effects of the FCU on children's language skill and inhibitory control. Findings revealed that the FCU was related to changes in positive behavior support, which predicted changes in children's language skill over time (Lunkenheimer et al., 2008). Similarly, Head Start REDI (Research-based, Developmentally Informed), an enrichment preschool curriculum promoting school readiness in Head Start classrooms, found significant effects on child vocabulary and parent reports of child language at home (Bierman et al., 2008). However, these studies did not examine the improvement of specific parenting skills (e.g., praise) as a mediator between treatment and child language among children with and at risk for developmental delay.

Only two child-centered interventions have been designed to target both child problem behaviors and language performance, and research providing support for these interventions is limited. First, the Blended Communication and Behavior Support (BCBS) program is an intervention designed to teach parents to model developmentally appropriate language, respond to their child's communication, and provide contingent consequences for compliance and noncompliance. BCBS has been examined using single-subject methodology with nine 36 to 46-month-old children with language delays and emergent problem behaviors across two different studies (Delaney & Kaiser, 2001; Hancock, Kaiser, & Delaney 2002). Post-intervention changes observed included positive changes in parenting behavior (e.g., increased consequences for compliance and noncompliance) and child behavior (e.g., increased percentage of compliance and noncompliance), although only modest changes in child language performance. However, significance testing was not conducted due to the single subject design of both studies. In addition to the limited improvement in child language skills, the small sample decreases generalizability of the findings, and the lack of a control group limits the ability to rule out internal threats to validity (e.g., regression to the mean).

The second intervention called Success in Parenting Preschoolers (SIP2) is a parent-training program targeting language facilitation, behavior management, and family stress among economically disadvantaged families with typically developing children. In a randomized trial with 40 children and their parents (Fanning, 2008), children randomized to receive SIP2 displayed significant increases in receptive language, daily behavior, nonverbal intelligence, and memory compared to children randomized to a control group. Despite the demonstrated improvements in both language and behavior, SIP2 was not developed for children with developmental delay. Additionally, children in this study were identified as at-risk for behavior problems and did not exhibit clinically significant levels of behavior problems. Therefore, further examination of parent-training programs targeting both behavior problems and language is important in order to streamline intervention efforts for children with clinically elevated behavior problems and with or at risk for developmental delay.

Parent-Child Interaction Therapy

Parent-Child Interaction Therapy (PCIT) is an evidence-based behavioral parent-training intervention for treatment of disruptive behavior in young children that incorporates the use of nondirective play to increase positive parent-child interactions (Eyberg, Nelson, & Boggs, 2008). Treatment is divided into two distinct phases, Child-Directed Interaction (CDI) and Parent-Directed Interaction (PDI). During CDI, parents are taught to increase their use of "PRIDE" skills and direct them toward appropriate child behavior and ignore inappropriate child behavior. Specifically, the PRIDE skills stand for *Praising* (statements expressing positive evaluation of the child), *Reflecting* (statements with the same meaning as a preceding child verbalization), *Imitating* (imitating the child's appropriate play), *Describing* (statements describing the child's current actions), and *Enjoyment* (enjoying play time with the child). To assess parent skill acquisition during each session, the therapist codes the frequency of each "do skill," defined as the number of praises, reflections and descriptions the parents use, and indicates whether the other PRIDE skills (i.e., imitation and enjoyment), as well as ignoring (if applicable), were "satisfactory" or "needs practice." During PDI,

parents learn to use direct commands and consistent consequences for child compliance and noncompliance initially during play and eventually learning to generalize the skills throughout the day and in other settings (e.g., public). PCIT has been shown to be effective in two large randomized trials for typically developing preschoolers with disruptive behavior disorders (Nixon, Sweeny, Erickson, & Touyz, 2003; Schuhmann, Foote, Eyberg, Boggs, & Algina, 1998), as well as among children with and at-risk for developmental delay (Bagner & Eyberg, 2007; Bagner, Sheinkopf, Vohr, & Lester, 2010). However, to our knowledge, no research has examined whether PCIT is associated with improvements in child language outcomes.

PCIT utilizes many of the key components known to foster language development. For instance, Hart and Risley (1995) identified parenting behaviors that closely resemble the PRIDE skills (e.g., “they listened”). In fact, research has demonstrated that parenting style and children's receptive language at 3 years shared 61% of the variance, and that parenting style was longitudinally associated with child receptive language at age 9 (Hart & Risley, 1995). Core components of PCIT (e.g., PRIDE skills) are similar to “parallel talk” procedures that are used in speech-language interventions, suggesting PCIT may also lead to improvements in language in addition to already established decreases in child disruptive behavior. In a conceptual paper, Tempel, Wagner, and McNeil (2008) reviewed the PCIT and language development literatures to demonstrate how parents receiving PCIT can learn the necessary skills to help decrease child disruptive behaviors and simultaneously foster child language production. However, no empirical research to date has examined the effect of PCIT on child language production.

Do Skills as a Potential Mediator of Child Language Improvements

Taken together, the studies reviewed above suggest promoting positive parent-child interactions is associated with improvements in child language and behavior. However, the mechanisms driving this relation remain unclear. It is possible that the extent to which parents utilize skills taught in both language and behavioral interventions (e.g., parallel talk and child-directed speech style; Hart & Risley, 1995) mediates the relation between treatment and improvements in behavior and language. Preliminary work suggests that increases in parent do skills following PCIT mediated changes in child disruptive behavior among children with developmental delay (Bagner & Eyberg, 2007). However, the mediating role of parent skill acquisition on child language in PCIT has not been examined.

The Current Study

The current study is one of the first to examine the effect of a behavioral parent-training intervention on language production with children with and at-risk for developmental delay. Based on previous research indicating that the frequency and quality of the parent-child interaction play a crucial role in the child's later language ability, we predicted that children randomized to receive PCIT would demonstrate greater gains in language production as measured by the child's different words (i.e., “word types”) spoken during child-directed play than children randomized to the waitlist control group. Different words and total words were chosen as markers of child language production given evidence suggesting that young

children who experience more child-directed speech by the caregiver, the primary focus of the CDI phase in PCIT, become better at processing familiar words and as a result have larger expressive vocabularies (Weisleder & Fernald, 2013). In addition, we hypothesized that there would be a mediating effect of the use of parent do skills on the relation between group and child language. Specifically, mothers in the PCIT group were expected to use more do skills than mothers in the control group, and an increase in the use of do skills would predict increases in child language production as measured by the child's different words during a child-directed play. Overall, the goal of this study was to examine the extent to which a parent-training intervention targeting child behavior problems can simultaneously help to foster language production among children with and at-risk for developmental delay, which would have implications for streamlining child behavioral and language interventions.

Method

Participants

Participants included 46 children (76% male) who were, on average, 45.09 months old ($SD = 14.40$; Range = 20-70 months) and presented with elevated externalizing behavior problems and also had or were at risk for developmental delay. All child participants were accompanied by their mothers ($M = 35.63$ years, $SD = 6.66$ years; Range = 25-55). The racial or ethnic composition of the child participants was 82% Caucasian, 7% African American, 9% Biracial, and 2% Hispanic. The racial or ethnic composition of the primary caregiver, which was the mother in all families, was 92% Caucasian, 4% African American, and 4% Biracial. The mean IQ for the child participants was 67.59 ($SD = 30.53$), and most (73.9%) children had IQ scores ≥ 80 . Research suggests that a higher cutoff of 80 for developmental delay can be used in young children due to the more favorable sensitivity and specificity values at 1.5 SD below the mean (Elbaum, Gattamorta, & Penfield, 2010). Participants enrolled in this study were referred to an outpatient psychology clinic for treatment of behavior problems primarily by pediatric health care professionals (84%), with an additional 5% referred by teachers, 3% referred by staff at state-funded early intervention programs, and 8% self-referred. Parent-child dyads included in the present study participated in one of two pilot randomized clinical trials and were randomly assigned to either a treatment or waitlist control group.

In study A, the sample consisted of children with developmental delay and were between the ages of 36 and 70 months ($n = 21$). Dyads were randomly assigned to receive PCIT in an immediate treatment (IT) group ($n = 10$) or wait 4 months to receive treatment in a waitlist (WL) control group ($n = 11$). Inclusion criteria included a parent-completed cognitive screening measure called the *Wonderlic Personnel Test* (WPT; Dodrill, 1981), along with a parent rating of the child's externalizing behavior problems using the Child Behavior Checklist for 1½- to 5-Year-Olds (CBCL; Achenbach & Rescorla, 2001). Mothers obtaining a standard score of 75 or higher on the WPT, and children scoring above the borderline clinically significant range (i.e., T-score > 64 on the Aggressive Behavior subscale) on the CBCL were included in the final sample. Parent-child dyads were excluded when evidence of a major sensory impairment (e.g., deafness, blindness), autism spectrum disorder, or significant motor impairment (e.g., cerebral palsy) in the child was reported. The dropout

rate for study A was 47%, with 7 dropouts from the IT group and 3 dropouts from the WL control group.

In study B, the sample included children who were at-risk for a developmental delay due to premature birth (i.e., < 37 weeks gestation) and were between ages 20 and 60 months ($n = 25$). The entire sample of children born premature was included in the current study because of their increased risk for developmental delay given evidence for deficits in physical, cognitive, and socio-emotional functioning that may emerge later in childhood (i.e., school age; Bennett, 1988), as well as evidence highlighting language deficits in later childhood when compared to full-term children (Crnic, Ragozin, Greenberg, Robinson, & Basham, 1983). The literature emphasizes that many of these difficulties (e.g., physical, cognitive, and socio-emotional functioning) do not emerge in children born premature until school age, when it is necessary for children to use higher-level skills (e.g., language, visual-spatial, and social competencies; Browne, 2003; Censullo, 1994; Spittle, Orton, Doyle, & Boyd, 2007). In addition, the use of IQ testing with children born premature may not adequately assess for developmental delay. Research suggests that IQ scores mask subtle deficits that may not be detected using standardized testing and that the emergence of difficulties in school-age preterm children might be due to these underlying subtle cognitive deficits (Aylward, 2002). Although some children were not below an IQ score of 80 at the time of testing, this does not mean that they were not at risk for subsequent delay, and therefore, were included in the analyses. Nevertheless, the model described below yielded comparable results when excluding children above 80 from the analyses.

Dyads in study B also were randomly assigned to receive PCIT in an IT group ($n = 11$) or wait 4 months to receive treatment in a WL control group ($n = 14$). Inclusion criteria included a parent-completed cognitive screening measure called the *Wechsler Abbreviated Scale of Intelligence* (WASI; Wechsler, 1999), as well as a parent rating of the child's externalizing behavior problems using the Child Behavior Checklist for 1½- to 5-Year-Olds (CBCL; Achenbach & Rescorla, 2001). Mothers obtaining a standard score of 75 or higher on the WASI, and children scoring above the borderline clinically significant range (i.e., T-score > 60 on the Externalizing Problems scale) on the CBCL were included in the final sample. Parent-child dyads were also excluded when evidence of a major sensory impairment (e.g., deafness, blindness), autism spectrum disorder, or significant motor impairment (e.g., cerebral palsy) in the child was reported. The dropout rate for study B was 21%, with 3 dropouts from the IT group and no dropouts from the WL control group.

Families that completed both Time 1 and 2 assessments ($n = 46$) from studies A and B were included in the current study (79% of the original samples). Across both studies, dyads were randomly assigned to an IT group ($n = 21$) or WL control group ($n = 25$). Dropout rates were not different across the two studies. In addition, families that completed treatment did not differ on any demographic or baseline variables from families that dropped out of treatment. The main behavioral outcome results for these two randomized controlled trials are reported elsewhere (Bagner & Eyberg, 2007; Bagner, Sheinkopf, Vohr, & Lester, 2010), and similarly found that PCIT led to significant improvements in children's disruptive behavior in children with and at risk for developmental delay. Furthermore, data from study

A suggests that do skills mediated improvements in child behaviors. However, the primary outcome papers did not examine the effect of parenting skills on child language production.

Screening Measures

Maternal Cognition Screener—The *WPT* (Dodrill, 1981), used in study A, and the *WASI*, used in study B (WASI; Wechsler, 1999), are short and reliable measures of adult cognition that were used to exclude mothers with cognitive impairment (i.e., IQ estimate < 75).

Child Cognition Screener—The Wechsler Preschool and Primary Scale of Intelligence-Third Edition (WPPSI-III; Wechsler, 2002) was administered to assess cognitive functioning in children 3 years of age and older in studies A and B, whereas the Bayley Scales for Infant and Toddler Development – Third Edition (Bayley, 2006) was administered to assess cognitive ability in children younger than 3 years in study B. Both tools are reliable and widely used to assess cognitive functioning in young children. For study A, the child was required to have a developmental delay (IQ score < 75 on a measure of cognitive functioning). In study B, child IQ data was collected for descriptive purposes. Child IQ was included as a covariate in the analyses in the current study.

Child Autism Screener—The *Childhood Autism Rating Scale (CARS)* (Schopler, Reichler, & Renner, 1988) was administered to identify children with symptoms of autism in study A. The *Modified Checklist for Autism in Toddlers (M-CHAT)* (Robins, Fein, Barton & Green, 2001) was administered to identify children with symptoms of autism in study B. Parent report was used in conjunction with clinical judgment for identification of autism in children older than 48 months. Both measures were used to exclude children with symptoms of autism spectrum disorder.

Child Behavior Screener—The Child Behavior Checklist for 1½- to 5-Year-Olds (CBCL; Achenbach & Rescorla, 2001) is a 99-item parent-report checklist designed to assess 18-to 60-month-olds' frequency of behavioral and emotional problems with excellent psychometric properties. Children with a T-score > 64 on the Aggressive Behavior subscale and or a T-score > 60 on the Externalizing Problems scale were included in the final sample.

Procedure

Both studies were approved by the affiliated Hospital Institutional Review Board and included a randomized, controlled trial to evaluate the efficacy of PCIT compared to a WL comparison group. Families were asked to complete a screening assessment and once eligibility criteria were met, they were randomly assigned to either the PCIT group or the WL comparison group at the baseline assessment. Mothers were videotaped with their child during a 5-min session of child-directed play at the initial baseline assessment (Time 1), and at a second assessment 4 months later (Time 2) after the PCIT families had completed treatment and the WL families had completed the 4-month wait list period. Each 5-min child-directed play period was conducted in the clinic, using age appropriate toys (e.g., blocks, farm house). Within each study, the same toys were used for both assessments and were different from the toys used during treatment sessions. The toys were strategically

placed in the same spot in the playroom (e.g., on floor, table), and mothers were instructed to follow their child's lead in play.

Coding and Reliability

The Dyadic Parent-Child Interaction Coding System – Third Edition (DPICS-III; Eyberg, Nelson, Duke, & Boggs, 2004) is a reliable and valid measure of the quality of parent-child interactions. This measure was used to video code parent and child behaviors by recording the frequency of their occurrence (in real time). As described above, do skills were calculated by adding the total number of behavior descriptions, reflections, and praises the mothers used during the 5-min child-directed play during the Time 1 and 2 assessments. Undergraduate research assistants were trained to 80% agreement with a criterion tape and were uninformed of group status. Half of the observations were coded a second time for reliability, and average Kappa scores were adequate (range from .61 - .76).

The Child Language Data Exchange System (CHILDES; MacWhinney, 2000) was used to transcribe parent and child language use during the child-directed play periods. *CHILDES* consists of three sections: a) Database of language transcripts, b) Codes for Human Analysis of Transcripts (CHAT), and c) Computerized Language Analysis (CLAN). The CHAT program provides a standardized way of creating language transcripts, while the CLAN program allows users to analyze language transcripts (Parker & Brorson, 2005). We transcribed children's use of language during both Time 1 and 2 assessments using CHAT, and analyzed children's language ability (i.e., total words and different words) using CLAN. Two trained undergraduate research assistants, uninformed to group status, transcribed child language. Twenty percent of the transcripts were transcribed by a second research assistant, and inter-rater reliability estimates were 85% for different words and 89% for total words.

Child language measures analyzed in the current study included the number of total words used (i.e., “word tokens”) and the diversity of words used (i.e., number of different words or “word types”).

Total words is a measure of overall words produced and is calculated by counting up the number of actual words used. Different words is a measure of lexical diversity that refers to the number of “unique” words used. For example, a child who says, “mommy, mommy, mommy, can you give me my drink” produced 9 total words and 7 different words (“mommy” was used three times but is only counted once in the different words calculation). Both total number of words and different words were calculated individually for each child at each time point. In the below analyses, the child's total amount of words used was included as a covariate to provide a more accurate estimate of different or new words.

Results

Preliminary Analyses

Demographic characteristics for study participants are presented in Table 1 and descriptive statistics for the study variables are presented in Table 2. Participants were compared on all demographic variables, and there were no statistically significant differences between IT and

WL groups (see Table 1). Additionally, there were no significant group differences at Time 1 different words, total words, and parent do skills (see Table 2). These results suggest successful randomization.

Outliers—Prior to analysis, the data were evaluated for multivariate outliers. Both model-based and non-model based outlier analyses were pursued. For non-model based outlier analyses, a leverage score was calculated for each individual, and an outlier was defined as any participant having a leverage score four times the value of the mean (Jaccard & Wan, 1993). One outlier was evident using this criterion. Model-based outliers were examined using limited information regression analyses for each of the linear equations dictated by the path models tested (Bollen & Long 1993). Standardized df beta values for each individual, predictor, and intercept were examined in order to isolate unusually influential individuals in parameter estimation. One outlier was defined as having an absolute standardized df beta larger than 1.0. Another outlier was evident using this criterion. Analyses were conducted both with and without the outliers and yielded comparable results. Therefore, all results reported included outliers.

Normality—Multivariate normality was evaluated using Mardia's index (Mardia, 1970). The multivariate Mardia coefficient yielded a statistically significant result (critical ratio = 5.48, $p < 0.05$). The data were also examined using univariate indices of skewness and kurtosis. This revealed skewness and kurtosis absolute values of 3.47 and 17.46, respectively for the measures of child IQ, which was expected based on the sample of developmentally delayed and at-risk children. Nonnormality was evident at both the multivariate and univariate level; therefore the model was evaluated using bootstrapping with 2000 bootstrap replicates and bias corrected interval estimation as implemented in AMOS. The p value for the overall fit of the tested models was calculated using the Bollen-Stine bootstrap approach in place of the traditional chi square statistic (Bollen & Stine, 1993). All significance tests and confidence intervals reported are from the bootstrap analyses (Table 3).

Covariates—Child IQ was included as a covariate given that children in study A had significantly lower IQ scores than children in study B, $t(44) = 4.19, p < .001$. Child age was also included as a covariate because the age criterion differed for children in study A (36 to 70 months) than children in study B (20 to 60 months). IT and WL families were compared on all other demographic variables, maternal do skills, child total words, and child different words. No other statistically significant differences emerged

Structural Equation Modeling

A single model, depicted in Figure 1, was used to examine the effects of PCIT on the number of child different words, both directly and indirectly through maternal do skills. Intercorrelations between model variables are presented in Table 3. A dummy variable (scored 1 or 0) for the two treatment conditions (IT versus WL) was defined and was assumed to impact the outcome in question. Six covariates were included in the analysis: (a) Time 1 child different words, (b) Time 1 maternal do skills, (c) Time 1 child total words, (d) Time 2 child total words, (e) child IQ, and (f) child age. Given that Time 1 maternal do

skills and Time 1 child different words were entered as covariates, the analysis reflected the effect of PCIT on covariate-adjusted change in child different words as mediated by change in maternal do skills. Time 1 and 2 child total words were also entered as covariates in order to provide a more accurate representation of the use of child new and different words, after controlling for total language production. The residual terms for Time 2 child different words and Time 2 total words were correlated, to allow for common unexplained variance. By including child language at Time 1 and Time 2, child age, and child IQ as covariates, we can account for possible differences in language skills and IQ across the combined sample. To ease interpretation, covariates of child age and child IQ, as well as the correlations between exogenous variables were excluded from Figure 1. Also, although the do skills variables and the language outcome variables represent counts, they were treated as continuous variables because the means and variability of each of the variables were considerably high.¹

Following the recommendations of Bollen and Long (1993), a variety of indices of model fit were evaluated. All indices examined suggested a good fitting model. The Bollen-Stine bootstrapped chi square test was not significant ($p = 0.676$). The Root Mean Square Error of Approximation (RMSEA) was < 0.001 . The p value for the test of close fit was 0.67. The Comparative Fit index (CFI) was 1.00. The standardized root mean square residual (SRMR) was 0.02. More focused analyses revealed no absolute standardized residuals greater than 1.96 and no modification indices. Figure 1 illustrates the standardized parameter estimates, with unstandardized coefficients in parentheses. All residuals and correlations are in standardized metrics.

Model effects—The joint significance test paradigm was used to test the mediation hypothesis. The joint significance method for testing mediation is recommended over other methods as it offers low Type I error rates while maximizing statistical power (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). This method simultaneously examines the significance of the paths from the focal independent variable to the intervening variable and from the intervening variable to the dependent variable. Results revealed that group (i.e., IT versus WL) was a statistically significant predictor of maternal do skills at Time 2; mothers in the IT group used on average 13.17 more do skills at Time 2 than mothers in the WL group. Additionally, maternal do skills at Time 2 was a significant predictor of different words at Time 2. In particular, a one-unit increase in maternal do skills used at Time 2 predicted a .48 unit increase in a child's use of different words. The joint significance of these paths provides support that maternal do skills at Time 2 mediates the effect of PCIT on child language production (after controlling for child age, IQ and the total words used at both Times 1 and 2). In addition, when examining the bias corrected confidence intervals associated with the effects mentioned above, the confidence intervals did not contain zero,

¹The main paths of importance are the paths from group to Time 2 maternal do skills and from Time 2 maternal do skills to Time 2 different words. The path from Time 2 maternal do skills to Time 2 different words reflects contemporaneous change, as each of these variables were measured at the same point in time. We therefore ran analyses two ways, once where the paths flowed from Time 2 maternal do skills to Time 2 different words, and once where paths flowed in the reverse direction. In both models, changes in maternal do skills covary with changes in different words, with the only difference being the direction of the effects. The paths between Time 2 maternal do skills and Time 2 different words were only significant in the model where paths flowed in the direction of do skills to different words. Because this result suggests the effects flow in the direction of the initial hypothesis, which is also consistent with previously conducted research (Weisleder & Fernald, 2013), we presented results using this model (see in Figure 1).

providing further evidence for mediation (see Table 4). Finally, the direct path from group to different words at Time 2 was not significant when examined within the context of the model including the mediator.

Discussion

Consistent with our hypothesis, findings revealed a mediating effect of maternal do skills on child different words, such that children whose mothers increased their use in do skills had a significant increase in child different words between Time 1 and 2. This is true even after controlling for child total words, IQ, and age, which increased confidence that findings were not merely due to an increase in total number of words over time. In addition to age being covaried in the analyses, age also was not correlated with IQ, providing further confidence that age did not impact the effect of parenting skills on child language. Findings revealed no significant direct effect of treatment condition on child different words at Time 2 after accounting for mediation.

Consistent with past research, the present study found that mothers' use of child-directed skills played an important role in the growth and improvement of child language (e.g., Girolametto & Tannock, 1994). This study replicated and extended previous findings by examining the mechanisms by which changes in parenting lead to child language improvements. Study results revealed findings that were consistent with our hypotheses. While PCIT did not directly lead to increased child language production, an indirect group effect emerged, meaning the mother's use of child-directed play skills (do skills) mediated the relation between PCIT and child language production. In other words, PCIT led to improved parenting skills, which, in turn, led to improved child language as measured by child different words. The use of randomized controlled trial methodology in the current sample has numerous strengths, particularly the ability to observe changes in child language above and beyond what is expected over time. Rapid language changes occur in early childhood, and children show enormous growth in productive vocabulary over time during these early years (Pan, Rowe, Singer, & Snow, 2005). Therefore, the changes observed in child language production following PCIT and mediated by maternal do skills are over and above what is expected in normal development.

To date, several interventions have been developed that target either child language (e.g., Girolametto & Weitzman, 2006) or child behavioral problems (e.g., Webster-Stratton, Reid, & Hammond, 2004). However, behavior problems may exacerbate difficulties with language and vice versa, thus impeding interventions individually targeting behavior or language (Baker & Cantwell, 1982; Rutter & Lord, 1987). To our knowledge, only two interventions were developed to treat both problems simultaneously, although research examining the effectiveness of these interventions has been limited (Delaney & Kaiser, 2001; Fanning, 2008; Hancock, Kaiser, & Delaney, 2002). Our results suggest that PCIT, which was initially designed to treat child behavior problems, can also help to improve child language development through the use of parenting skills. Specifically, the parent's use of child-directed play skills in the context of a behavioral intervention can have a positive impact on child language. Therefore, behavioral parenting-training interventions like PCIT can be an optimal treatment approach for children with and at-risk for developmental delay given the

high prevalence of comorbidity in this population. It is possible that the findings are specific to PCIT, which is more intensive than other parent-training interventions because of the use of in vivo coaching to prompt and reinforce parents' use of new skills during parent-child practice. Feedback through in vivo coaching may be an important mechanism of change given that it can be important for mastery of the PCIT skills. Therefore, it is important for future research to examine whether these findings extend to other evidence-based behavioral parent-training interventions.

The current study has some limitations, and it is important to interpret the results in light of these limitations. First, the sample included children with developmental delay or at risk for developmental delay, so the findings may not generalize to typically developing children with behavior problems. However, this study was an important first step in examining the effect of a behavioral parent-training program on child language. Second, the sample size was relatively small given that only treatment completers were included in the current study. This, in turn, limits power to detect effects. Therefore the data presented should be interpreted as preliminary. However, we used appropriate methods for small sample size situations (e.g., bootstrapping and bias-corrected confidence intervals; Fritz and MacKinnon, 2007) and did find significant effects despite limited power. Future studies should examine the mediating role of parent skill use on child language outcomes with a larger sample, as it may yield results that we may have been unable to detect, such as the direct effect of the intervention on language outcomes.

Third, data were collected only from the primary caregiver, which was the mother in all cases. Although we would not expect findings to differ given that both mother and father engagement directly relate to child language outcomes (Tamis, LeMonda, Shannon, Cabrera, & Lamb, 2004), future research should investigate if a mediating role of parenting skills on child language exists with fathers and other caregivers. A fourth limitation of the current study was the use of only two time points. Although mediation analyses can be tested with two data points, at least three time points are preferable for demonstrating mediation (Cole & Maxwell, 2003). Ultimately, conclusions involving the temporal direction of the observed associations among variables should be interpreted with caution. Nonetheless, the results provide preliminary support to the idea that the improvement in parenting skills following PCIT may help foster language production. Future studies should utilize at least three time points to verify the directionality of effects. Finally, the study used a limited number of language measures. However, the language measures used were more ecologically valid than other measures of child language development (e.g., standardized tests; Iacono, 1999). In addition, the use of a control group allowed us to rule out time as a confounding variable. Nevertheless, future studies should examine both expressive and receptive language using additional instruments that assess child language.

Despite these limitations, the present study addressed a relatively unexplored research question and provided preliminary findings that have important clinical implications. Findings suggest that behavioral parent-training interventions may be used as an effective method in targeting comorbid behavioral and language difficulties in children with and at risk for developmental delay. This can be particularly useful for community-based clinicians, who typically provide services for children with comorbid behavior and language

disorders (Steele, Elkin, & Roberts, 2008). By targeting both the child's behavior and language, PCIT can potentially serve as a cost-efficient treatment approach for children with and at risk for developmental delay.

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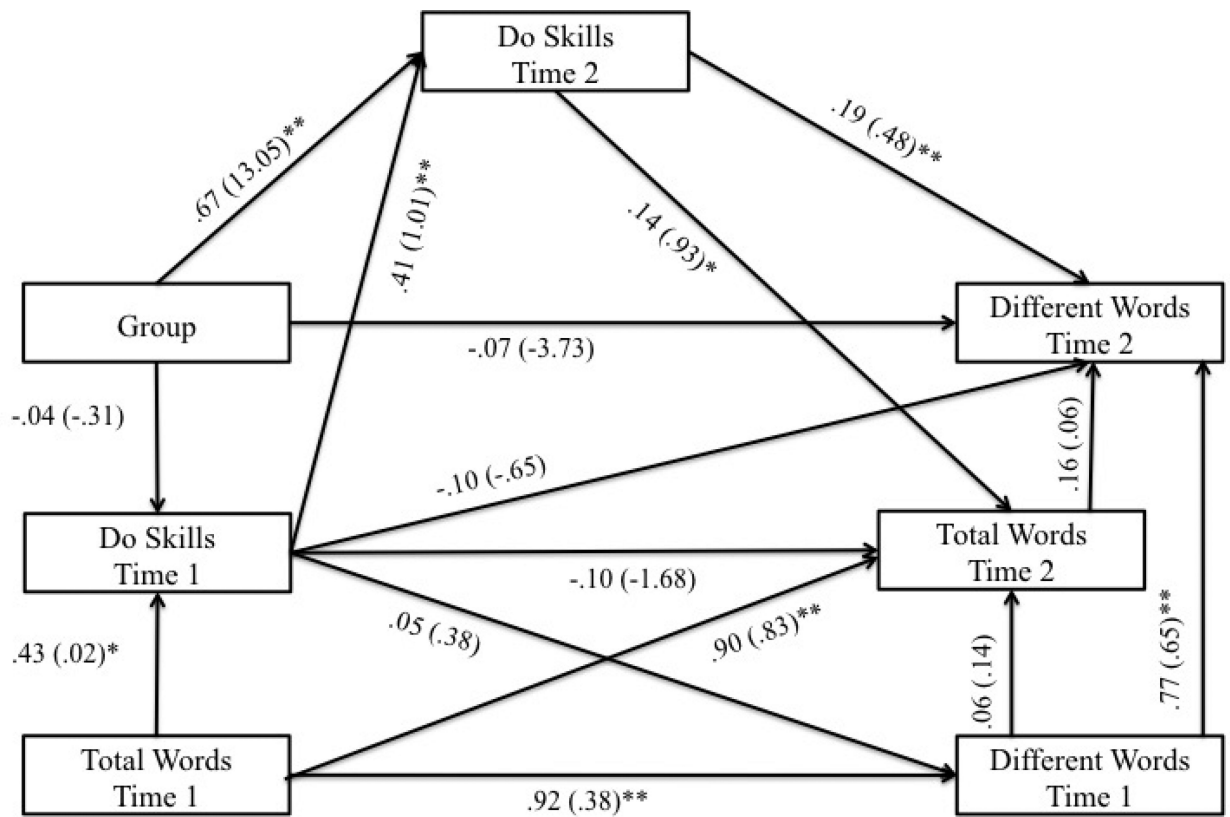


Figure 1.

Path model for effects of mother Time 2 Do skills on children's use of Different words at Time 2.

Note. The covariates of age and IQ as well as the correlations between exogenous variables were excluded from the figure to avoid clutter. Unstandardized values are in parentheses. * $p < .05$; ** $p < .01$.

Table 1

Demographic Characteristics of Groups

Characteristic	<i>M (SD) or percent</i>		<i>t/x²</i>
	IT (<i>n</i> = 21)	WL (<i>n</i> = 25)	
Child Age (months)	46.1 (13.9)	44.2 (15.1)	<i>t</i>
Child Sex (% male)	81.0	72.0	<i>x²</i>
Child Ethnicity (% minority)	19.0	20.0	<i>x²</i>
Child IQ	71.1 (18.7)	64.7 (37.9)	<i>t</i>
Mother Age	35.0 (7.4)	36.2 (6.1)	<i>t</i>
Mother Ethnicity (% minority)	14.3	4.0	<i>x²</i>

Note. IT = Immediate Treatment; WL = Waitlist Control

No difference approached statistical significance.

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Table 2

Descriptive Statistics for Child Language and Parenting Skills Measures

Characteristic	<i>M (SD) or percent</i>		<i>t(44)</i>	<i>p</i>
	IT (<i>n</i> =21)	WL (<i>n</i> = 25)		
Different Words Time 1	31.00 (28.49)	43.72 (30.57)	1.45	0.154
Different Words Time 2	36.48 (24.62)	45.44 (25.66)	1.20	0.236
Total Words Time 1	60.57 (68.74)	86.76 (74.38)	1.23	0.225
Total Words Time 2	72.57 (57.92)	90.40 (74.01)	0.90	0.375
Parent Do Skills Time 1	5.48 (4.07)	6.52 (3.70)	0.91	0.367
Parent Do Skills Time 2	17.05 (9.58)	5.80 (6.63)	-4.69	< .001

Note. IT = Immediate Treatment; WL = Waitlist Control

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Table 3

Intercorrelations between model variables

	1	2	3	4	5	6	7	8	9
1. Group	--								
2. DoSkillsT1	-0.14	--							
3. DoSkillsT2	0.58 **	0.31 *	--						
4. DiffWordsT1	-0.21	0.43 **	-0.05	--					
5. DiffWordsT2	-0.18	0.36 **	0.09	0.87 **	--				
6. TotalWordsT1	-0.18	0.41 **	-0.05	0.95 **	0.84 **	--			
7. TotalWordsT2	-0.13	0.34 *	0.06	0.87 **	0.94 **	0.91 **	--		
8. Age	0.07	-0.12	-0.06	0.12	0.12	0.12	0.16	--	
9. IQ	.11	0.06	-0.21	0.26	0.22	0.26	0.22	0.01	--

Note. Intercorrelations are Pearson correlations with the exception of group and all continuous variables, which are Point-Biserial correlations. T1 = Time 1, T2 = Time 2, SD= Standard Deviation.

**
p < .01.

*
p < .05.

Table 4

95% Confidence Intervals for Unstandardized Path Coefficients

Path	Unstandardized Coefficient	95% CI
Total Words Time 1 to Do Skills Time 1	.023	.008 to .041 *
Total Words Time 1 to Different Words Time 1	.383	.336 to .465 **
Group to Do Skills Time 2	13.047	9.253 to 17.310 **
Do Skills Time 1 to Do Skills Time 2	1.051	.380 to 1.727 **
Total Words Time 1 to Total Words Time 2	.832	.363 to 1.345 **
Do Skills Time 2 to Different Words Time 2	.484	.151 to .885 **
Do Skills Time 2 to Total Words Time 2	.933	.120 to 1.677 *
Different Words Time 1 to Different Words Time 2	.649	.395 to 1.319 **

Note. Only significant paths are included in the table.

*
 $p < .05$

**
 $p < .01$.