

Effects of Graphical Feedback and Coaching
on the Quantity and Quality of Parent-Child Language Interaction

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Abstract

The purpose of this study was to determine the effectiveness of an intervention to enhance the quantity and quality of parent-child language interactions among families experiencing multiple social and environmental risk factors. Four mother-child dyads participated. Participants were recruited through local agencies that provided services to families. All dyads were monolingual, English speaking, living below the federal poverty line, and exhibiting low levels of parent-child language interaction at baseline. A multiple baseline design across mother-child dyads was employed to evaluate two levels of intervention: 1) parent education about the importance of talk in conjunction with graphical feedback; 2) direct parent training in language promotion strategies in addition to parent education and graphical feedback. Dependent variables included adult word count, child vocalization count, and conversational turn count collected during a 2-hour intervention period. Data were collected using the Language ENvironment Analysis (LENA) system in the participant's natural home environment. Visual inspection of multiple baseline data indicated that the intervention was effective at increasing the amount parents talked to their children as well as the amount the children vocalized and the number of dyadic verbal exchanges the parent and child shared. The second phase of intervention which included direct parent training on language promotion strategies had the most robust effect. Directions for future research and implications for implementing home-based language environment interventions are discussed.

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Chapter 1

Introduction

Conversational features between parents and children vary greatly and substantially impact children's language development (Hart & Risley, 1995; Hoff, 2003; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991). Studies suggest that the amount of language to which a child is exposed is an important factor in vocabulary acquisition. Huttenlocher et al. (1991) concluded that 20% of the variance in child vocabulary size and rate of vocabulary growth was attributable to parent talkativeness.

Hart and Risley (1995) observed parent-child verbalizations once per month from 6 months to 3 years of age among 42 families. Their results demonstrated that class, defined by occupational status (welfare, middle, professional), correlated highly with the quantity, quality, and responsiveness of parental speech directed to children. The number of words addressed to a child per hour differed based on social class. The average child on welfare was exposed to half as many spoken words per hour (616 words per hour) as the average child from the working-class (1,251 words per hour) and less than one third of the words per hour an average child of a professional family experienced (2,153 words per hour). Similar class differences were also found for language quality. Professional parents utilized nouns, modifiers, past-tense verbs, auxiliary-fronted yes/no questions, declarative sentences, and affirmative feedback with greater frequency.

In addition to differences in the quality and quantity of language input children receive, striking social class differences were also detected in the ratio of affirmative to prohibitive feedback. The ratio of affirmative to prohibitive feedback was 6 to 1 for

professional families and 2 to 1 for working class families. On average prohibitions outnumbered affirmatives for welfare families at a ratio of 1 affirmative to 2 prohibitions. The professional parents provided their child affirmative feedback at twice the rate of working-class families, and more than five times as often as parents of welfare families. In a typical hour, a professional parent gave their child an average of 5 prohibitions whereas the welfare parents gave their children an average of 11 prohibitions per hour. Hart and Risley (1995) also concluded that an inverse relationship exists between social class and the function of parental speech. The higher the social class of parents, the less likely they are to use directive speech and the more likely they are to speak to their children in order to initiate and sustain conversation which research has demonstrated leads to language growth (Zimmerman et al., 2009).

Several studies have suggested that children who have the opportunity to interact with adults who facilitate language development have more advanced language skills, which in turn sets the foundation for the acquisition of early literacy skills (Anderson, Hiebert, Scott, & Wilkinson, 1985; Chall, 1990; Hart & Risley, 1995; Lonigan, Burgess, & Anthony, 2000; Rush, 1999; Shonkoff & Pianta, 2000; Snow, Burns, & Griffin, 1998; Tabors, Snow, & Dickinson, 2001). Language development at 30 months has been demonstrated to reliably predict reading ability at 8 years of age (Fewell & Deutscher, 2004). A significant amount of variance in elementary-grade reading ability can be accounted for by vocabulary and grammar tasks completed between the ages of 3 and 5 (Catts, Fey, Zhang, & Tomblin, 1999; Catts, Fey, Zhang, & Tomblin, 2001). Furthermore, language ability is often an area of weakness for students experiencing

reading difficulties (Catts et al., 1999; 2001). A follow-up to Hart and Risley's study assessed participants between the ages of 5 and 10 and demonstrated that language skills before 36 months were predictive of expressive and receptive language skill and reading ability from kindergarten to 3rd grade, thus underscoring the importance of early language development on later academic achievement (Walker, Greenwood, Hart, & Carta, 1994).

Studies linking frequency of parent utterances and language development of children offer valuable insight into ways to intervene early to get children on a trajectory of success. That is, understanding the developmental path to proficient reading allows for intervention to take place at a time point that proves most efficient and effective. Hart and Risley (1995) extrapolated their data to demonstrate the social class differences in language exposure in the first four years of a child's life. They concluded that in four years, an average child of a professional family would have experienced almost 45 million words, an average child in a working-class family would have experienced 26 million words, and average child in a welfare family would have experienced 13 million words. Based on these data, an intervention to equalize the language experience of the welfare children (62,000 words per week) with that of the working-class children (125,000 words per week) would have to provide the welfare children with 63,000 words per week of additional language experience. This would require 41 hours per week of intervention outside the home that provided the child with a language-rich environment equal to that in professional homes. They concluded that any program seeking to equalize the language experience of welfare children to that of working-class children

would have to start at birth and run year-round. Furthermore, the staff-to-child ratio would have to be almost one-to-one to simulate the individualized language experience provided by professional parents.

An intervention of this magnitude is likely outside the scope of many state-run early intervention programs. This information does however point to the importance of intervention beginning very early in an at-risk child's life. An intervention program that begins to work with children at age 3 would be hard-pressed to make up for three years of insufficient language input. Intervening early and intervening with families appears to be the best, most practical, choice for those working to equalize experiences and outcomes for children.

Research on interventions to increase positive parent-child interactions in an effort to improve child language outcomes has demonstrated positive results for families with children with developmental delays (Fey et al., 2006; Kaiser, Hancock, & Hester, 1998; Kaiser & Hancock, 2003; Yoder & Warren, 1998; Yoder & Warren, 2001; Yoder & Warren, 2002), teenage mothers (Deutscher, Fewell, & Gross, 2006; McGowan et al., 2008), and mothers with limited cognitive ability (Feldman et al., 1986; Feldman, Case, Rinvocer, Towns, & Betel, 1989; Feldman, Sparks, & Case, 1993). Few studies have examined the effectiveness of such interventions with families experiencing multiple social-environmental risk factors. However, the results of intervention studies to increase the quantity and quality of parent-provided language stimulation within families experiencing multiple risk factors are generally positive, suggesting that at-risk parents can be taught strategies for promoting their children's language development (Bigelow,

2006; Hancock, Kaiser, & Delaney, 2002; Peterson, Carta, & Greenwood, 2005). Factors associated with successful interventions for this population include one-to-one, in-home programs that include opportunities for the interventionist to model desired behaviors and provide the parent with coaching and feedback (Bigelow, 2006; Feldman et al., 1989; Peterson et al., 2005)

Purpose of Study

The purpose of the current study was to determine the effect of an intervention on the quantity and quality of parent-child language interaction. Two levels of intervention were assessed: 1) parent education about the importance of talk in conjunction with graphical feedback; 2) direct parent training in language promotion strategies in addition to parent education and graphical feedback.

Research Questions

1. Does parent education about the importance of talk in conjunction with graphical feedback increase parent-provided child language input?
2. Does conducting the Promoting Communications Intervention with parent-child dyads, which includes direct in-home parent training of language promotion strategies, increase the amount of parent-provided language input beyond that of parent education and graphical feedback alone?
3. Does increasing parent-provided language input increase child vocalizations? Is there a differential effect on child vocalizations between Phase 1 and Phase 2 of intervention?
4. Does increasing parent-provided language input increase conversational turns in a

parent-child dyad? Is there a differential effect on conversational turns between Phase 1 and Phase 2 of intervention?

5. If increases occur in adult word count, child vocalizations, and/or conversational turns, do these increases maintain?

Chapter 2

Literature Review

The skills with which children enter school and their subsequent academic success are strongly related and disturbingly stable (Baydar & Brooks-Gunn, 1993; Stevenson & Newman, 1986; Tramontana, Hooper, & Selzer, 1988). This phenomenon has been well documented in literacy research. Juel (1988) reported that the probability that a poor reader at the end of first grade would remain a poor reader at the end of fourth grade was .88. Skills acquired during the preschool years contribute to acquisition of reading and related skills in elementary school, and thus are related to proficiency in primary and later grades (Juel, 2006; Missall et al., 2007; Snow et al., 1998). The strong correlation between the skills a student enters school with and their later academic achievement has gained the attention of researchers, teachers, and policy makers interested in reducing the discrepancy in achievement between poor students and their more affluent peers.

Academic achievement and socioeconomic status (SES) are strongly correlated. Students' reading and writing abilities vary greatly as a function of the economic level of their parents (National Center for Educational Statistics, 1998). Children living in poverty are the largest group of children who are at risk for school failure in the United States (Shonkoff & Pianta, 2000; Vernon-Feagans, Hammer, Miccio, & Manlove, 2001). Although children living in poverty often display deficits in numerous areas of achievement, early reading is the foundation for later academic and social success in school and, therefore, may be the most advantageous focus area for early intervention

(Whitehurst & Lonigan, 2001). The discrepancy in reading achievement between children from lower-income environments and their more affluent peers is present at the beginning of formal instruction, implying a deficit before children enter formal schooling (i.e., a deficit in their emergent literacy skills; Whitehurst & Lonigan, 2001).

Emergent literacy refers to the skills, knowledge, and attitudes recognized to be developmental precursors to conventional forms of reading and writing (Adams, 1990; Whitehurst & Lonigan, 2001). The acquisition of literacy through this perspective asserts that literacy develops along a developmental continuum that begins very early in life (Whitehurst & Lonigan, 1998). This conceptualization differs from the traditional view that reading begins with formal schooling and that experiences prior to that contribute only to reading readiness. Emergent literacy skills include oral language, knowledge of print and letters, and phonological awareness (Whitehurst & Lonigan, 1998) and are highly correlated with later reading achievement (Lonigan et al., 2000).

Indeed, research has demonstrated that children from low-income backgrounds begin kindergarten behind their peers with regard to emergent literacy skills including language ability (Hart & Risley, 1995) and phonological sensitivity (Dickinson & Snow, 1987). Unfortunately, research does not suggest that this gap disappears once children enter formal schooling, but to the contrary, the gap between those with less developed literacy skills and those with better developed literacy skills widens across the years in school (Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996; Hamre & Pianta, 2005; Stanovich, 1986; Whitehurst & Lonigan, 2001). Thus, the most effective and efficient

time to intervene may be prior to formal schooling when vital emergent literacy skills are developing.

What happens in the years prior to a child entering formal schooling appears to impact the effects of subsequent educational experiences. The emergent literacy skills children develop through their experiences in their homes, preschools, and childcare settings are related to their later reading success (Hart & Risley, 1995; Weigel, Martin, & Bennett, 2005; Whitehurst & Lonigan, 1998).

Oral Language Skills and Academic Achievement

Oral language development appears to be an important component of children's progression toward literacy. This relationship is well-documented by longitudinal studies examining the correlation between oral language ability and later reading, spelling, and writing proficiency among typically developing, language-delayed, and reading-delayed children (Butler, Marsh, Sheppard, & Sheppard, 1985; Scarborough, 1990; Share, Jorm, MacLean, & Matthews, 1984; Walker et al., 1994). The influence of oral language skills on literacy development begins early and persists into the elementary years. Language ability, measured by mean length of utterance, at 20 months of age correlates with phonological awareness at 4.5 years of age (Crain-Thoreson & Dale, 1992). Language development at 30 months is a reliable predictor of reading ability at 8 years (Fewell & Deutscher, 2004). A significant amount of variance in elementary-grade reading ability can be accounted for by vocabulary and grammar tasks completed between the ages of 3 and 5 (e.g., Catts et al., 1999; Catts et al., 2001). Furthermore, language ability is often an area of weakness for students experiencing reading difficulties (Catts et al., 1999; 2001).

Although the correlation between oral language and reading ability is strongly supported, less information about the process through which oral language impacts reading acquisition is available. Whitehurst and Lonigan (1998; 2001) discuss literacy in terms of a person's ability to draw upon two domains of information which they term *outside-in* and *inside-out skills*. Inside-out skills include knowledge of print units and sound units, and refer to a reader's ability to decode words including their understanding of grapheme-phoneme correspondence, phonemic awareness, and letter knowledge. Outside-in skills, including semantic knowledge and vocabulary, refer to a reader's ability to use knowledge from "outside" the printed word (e.g., background knowledge) to make sense of the word they are decoding. The role oral language plays in reading is dependent on the stage of literacy development of the child. For pre-readers, vocabulary appears to play a vital role in learning to decode written language. Vocabulary acquisition aids in the development of phonological sensitivity and provides the child with the request knowledge to draw a connection between the word they decoded and a previously held semantic representation. For older readers, who have mastered the ability to decode words, oral language is related to comprehension. Those with greater vocabularies, and thus more semantic knowledge, are better able to extract meaning from text, the primary motivation for reading at all stages. As children's vocabularies grow they are able to begin to segment and blend parts of words to make a new word which in turn increases their vocabulary (Burgess & Lonigan, 1998; Wagner, Torgesen, Laughon, Simmons, & Rashotte, 1993; Wagner et al., 1997). Among both pre-readers and readers, oral language and reading have a bidirectional relationship. Better-developed oral

language skills not only help children read but improved reading enhances the child's language skills as new words and ideas are encountered and mastered.

Several studies have supported the assertion that early language development plays a role in the acquisition of early literacy skills (Anderson et al., 1985; Chall, 1990; Hart & Risley, 1995; Lonigan et al., 2000; Rush, 1999; Shonkoff & Pianta, 2000; Snow et al., 1998; Tabors et al., 2001). A seminal study by Hart and Risley (1995) demonstrated that the language environments children are exposed to vary greatly by family SES, and that these differences in the quality and quantity of language input affect children's language and intellectual development. A follow-up with these participants between the ages of 5 and 10 demonstrated that language skills before 36 months were predictive of expressive and receptive language skill and reading ability from kindergarten to 3rd grade, demonstrating the importance of early language development on later academic achievement (Walker et al., 1994). Walker et al. (1994) concluded from their study that "early SES-related differences in parenting may, therefore, not only lead to differences in early language and intellectual outcomes, but these differences appear to be further maintained in the context of schools. These findings support the contention that both early home and schooling factors related to SES may place children at risk for progressive and cumulative poor performance in early elementary school."

Beyond implications for literacy development, oral language ability also has been demonstrated to affect children's social, emotional, and behavioral development, particularly among children from low-income families (Fagan & Iglesias, 2000; Owens, Shaw, Giovannelli, Garcia, & Yaggi, 1999; Qi & Kaiser, 2004). One study examined the

behavioral profiles of sixty 3- and 4-year-old children from low-income families enrolled in Head Start programs. They compared children with language delays to those with typical language development and concluded that children with language delays exhibited more problem behaviors and had less mature social skills than children with typically developing language. The authors noted the importance of early detection and intervention of language delays to avoid these cumulative effects on other areas of development (Qi & Kaiser, 2004).

Home and Family Effects on Language Development

A generous amount of research has focused on discovering the variables that are predictive of children's developmental outcomes. Historically, biological factors were thought to be the cause of most delays in development. However, contemporary research has demonstrated that social-environmental risk factors are the cause of a significant number of cases of mild cognitive delay (Sameroff, Seifer, Barocas, Zax, & Greenspan, 1987). Armed with this knowledge, researchers set out to determine what aspects of children's environments had the greatest impact on their development. Socio-economic status (SES) is a widely cited environmental risk-factor for developmental delay.

Although the fact that SES accounts for a significant amount of variance in developmental outcomes is indisputable, the basis for this conclusion is unclear. SES serves as a marker variable for a host of other variables that affect developmental outcomes.

Sameroff et al. (1987) sought to determine the impact of 10 environmental variables, each of which correlate highly with SES, on the intellectual development of

215 children at the age of 4. Social-environmental variables included maternal mental health, maternal anxiety, parental perspectives, mother interactive behaviors, maternal education, occupation of head of household, minority group status, family social support, family size, and stressful life events. To compare the predictive power of these 10 variables to that of SES, a hierarchical multiple regression was completed. As expected, SES accounted for a large proportion of variance in verbal IQ ($r = .59$, $p < .001$). However, when the 10 environmental variables were entered as the second step in the regression equation, SES being the first, the model accounted for significantly more variance than SES alone ($r = .71$, $p < .001$).

Sameroff's model highlights the important effect of cumulative risk. An inverse relationship between the number of risk factors experienced and verbal IQ score at age 4 was found: As the number of risk factors increased verbal IQ decreased. The authors concluded that no single variable was the culprit for poor developmental outcomes, but the combination of multiple risk-factors was the cause of reduced intellectual performance. Carta et al. (2001) utilized the cumulative risk approach validated by Sameroff et al. (1987) to examine the effects of cumulative prenatal substance exposure and cumulative environmental risk on the developmental trajectories of young children. They found that models of cumulative environmental risk accounted for more variance in developmental trajectories than prenatal substance exposure, supporting the argument that social-environmental factors play a strong role in early development and that cumulative risk is the most detrimental. Carta et al. (2001) concluded that children in

families with three or more cumulative risk factors were at significant risk for developmental delay.

Of the 10 social-environmental risk factors described by Sameroff et al. (1987), most are highly stable and few are amenable to the typical early intervention program. Factors such as minority group status and family size are unalterable. Others such as maternal education, maternal mental health and anxiety, occupation of head of household, and marital status can be improved, but are likely outside the scope of early intervention programs. Parental perspectives as defined by this study may be difficult to change as they represent deeply rooted and culturally tied beliefs. The one variable in the study that does lend itself to intervention is mother's style of interaction with her child, which was measured by observations of mother smiling, vocalizing, or touching her child.

Maternal responsivity. Maternal responsivity, similar to maternal interactive style, has been demonstrated to play a significant role in child language development and later reading success (Fewell & Deutscher, 2002; Fewell & Deutscher, 2004; Mahoney, Boyce, Fewell, Spiker, & Wheeden, 1998; Tamis-LeMonda, Bornstein, & Baumwell, 2001). Fewell and Deutscher (2004) analyzed the contributions of four variables (children's expressive language scores at 30 months of age, mother's facilitation of child language, mothers' education, and group assignment) to the prediction of IQ at age 3, verbal IQ at ages 5 and 8, and reading at age 8 for 571 children at risk due to low birth weight. Four separate multiple regressions revealed that maternal facilitation of language was a significant contributor in each of the models. Mahoney et al. (1998) conducted a meta-analysis investigating the role of maternal interactive style on early intervention

outcomes. They concluded that the most critical determinant of intervention success was whether the mother of the target child increased their level of responsiveness to their child. Similarly, Tamis-LeMonda et al. (2001) found that after controlling for children's observed behaviors, maternal responsiveness to their child at ages 9 and 13 months contributed to whether or not the child achieved language milestones. Studies such as these clearly indicate that intervention to enhance the development of children at risk for poor language, and subsequently poor reading, outcomes should include intervention to increase parental responsiveness and language facilitation.

Home-literacy environment. A large amount of research has been conducted to determine the aspects of the home-literacy environment that impact language development. These include frequency of reading with the child, the number of books in the home, and the frequency of caregiver-child library visits. Several studies argued that parental characteristic variables such as maternal IQ and education account for the majority of variation in correlation between home-literacy variables and child language development (e.g., Scarborough & Dobrich, 1994). However, Payne, Whitehurst, and Angell (1994) refuted this conclusion and reported that the literacy environment accounted for substantially more variance in child-language scores than primary caregiver IQ and education combined. They concluded that the literacy environment accounts for 18.5% when effects of caregiver IQ and education are included and 12% after variance due to caregiver IQ and education are parceled out. Although some may argue that 12% is a relatively small amount of the variance in child-language scores, the

fact that home-literacy environment is one of the few malleable variables attributing to children's early language development makes it a clear target for intervention.

Home literacy environment and preschool language ability are highly correlated (e.g., Beals, De Temple, & Dickinson, 1994; see review by Bus, van Ijzendoorn, & Pellegrini, 1995). Aspects of the home-literacy environment, such as number of books in the home, library visits, and parents' own print exposure, have been reported to relate to children's vocabulary skills. However, in one study only frequency of library visits was related to children's vocabulary after controlling for the effects of children's print exposure (Sénéchal, LeFevre, Hudson, & Lawson, 1996). Similarly, Payne et al. (1994) concluded that adult literacy activities such as the amount of time parents spend reading for pleasure does not correlate highly with children's oral language. Aspects of the home environment that did appear to impact children's oral language skills included those that directly involved the child such as frequency of shared reading, number of children's books in the home, and frequency of library visits with the child.

Shared book reading is a commonly recommended way for parents to support their children's language and emergent literacy development (Bowman, Donovan, & Burns, 2001; Boyer, 1991; Snow et al., 1998). The idea that storybook reading promotes language development is well supported in the literature by correlational, experimental, and intervention studies (for thorough review see Bus et al., 1995; for meta analysis see Scarborough & Dobrich, 1994). Even after controlling for parental education, parental level of literacy, and children's analytic intelligence, exposure to storybook reading still accounted for unique variance in preschool children's expressive and receptive

vocabulary (Sénéchal et al., 1996). Experimental studies have demonstrated the power of shared book reading on vocabulary development by showing vocabulary gains by children after just one reading of a book (Sénéchal & Cornell, 1993).

Differences in the frequency of shared book reading between low- and middle- or high-SES families have been documented. The Federal Interagency Forum on Child and Family Statistics (2000) surveyed a representative American sample and found that 38% of low-income parents read to their 3-5-year-old children daily and 22% had taken their children to the public library at least once in the past month. Comparatively, 58% of families above the poverty line read to their 3-5-year-old children daily and 40% reported having taken their children to the library at least once in the past month. A nationwide study of American kindergarten children revealed similar results: 36% of parents in the lowest-income quintile reported reading to their children on a daily basis, whereas 62% of parents from the highest-income quintile reported reading to their children on a daily basis (Coley, 2002). These discrepancies in frequency of shared book reading between low and high SES families may account for some of the variance in early language development.

Parent-child conversational features. Conversational features in homes are related to parental responsiveness. These features vary greatly among households and they substantially impact children's language development (Hart & Risley, 1995; Hoff, 2003; Huttenlocher et al., 1991). Further, the amount of language a child is exposed to is an important factor in vocabulary acquisition. Huttenlocher et al. (1991) concluded that

20% of the variance in child vocabulary size and rate of vocabulary growth was attributable to parent talkativeness.

Hart and Risley (1995) observed parent–child verbalizations for one hour, once per month, from 6 months to 3 years of age among 42 families. Observations took place in the participants' homes. Observers used tape recorders to capture parent and child verbalizations and manually recorded a running record of the child's context, actions, and interaction. These data were then transcribed and coded for types of language used and interactions between children and adults. The primary dependent variables included features of the parent and child's verbalizations including the child's vocabulary growth rate and family interaction patterns. Their results demonstrated that class, defined by occupational status (welfare, middle, professional), correlated highly with the quantity, quality, and responsiveness of parental speech directed to children. Simply examining the number of words a child heard per hour revealed striking differences based on social class. The average child on welfare was exposed to half as many spoken words per hour (616 words per hour) as the average child from the working-class (1,251 words per hour) and less than one third of the words per hour an average child of a professional family experienced (2,153 words per hour). Similar class differences were also found for speech quality (e.g., nouns, modifiers per utterance). Professional parents utterances were not only more frequent but richer in terms of certain quality features. That is, professional parents utilized nouns, modifiers, past-tense verbs, auxiliary-fronted yes/no questions, declarative sentences, and affirmative feedback with greater frequency. Finally, striking social class differences were detected in affirmative feedback. The professional parents

provided their children with affirmative feedback at twice the rate of working-class families and more than five times as often as parents of welfare families. In a typical hour, a professional parent gave their child an average of 5 prohibitions whereas the welfare parents gave their children an average of 11 prohibitions per hour. The children in the welfare families were exposed to twice as many prohibitions as affirmatives.

Hart and Risley (1995) also concluded that an inverse relationship exists between social class and the function of parental speech. All families used directive speech in order to alter their children's behavior, however, parents who talked more to their children went beyond this directive speech to initiate and sustain reciprocal conversations. Interestingly, Hart and Risley found that as parents talked more the function of the interactions changed. When families moved beyond speech with a specific purpose, such as getting the child to put their shoes on, they tended to ask more questions, prompt their children to participate, and expand upon what the child said to keep the conversation going. This suggests that simply increasing the amount parents talk to their children could also alter the function of speech, providing more opportunities for reciprocal discourse.

Recent research has demonstrated the significance of adult-child conversations on child language development. Zimmerman et al. (2009) utilized regression analysis to test the association of adult language input, television viewing, and adult-child conversations on language acquisition. Results showed that all three variables had significant impacts on child language development: television viewing had a negative impact, conversational turns and adult language input positively impacted language development. However,

when entered into a single regression, adult word count and television exposure were no longer significant, suggesting that the variance in child language development was attributable to conversational turns. Based on these findings, the authors concluded that although adult language input is important for child-language development, conversational turns appear to be most predictive of language outcomes.

Other research, however, supports the idea that children have the ability to learn words through simply overhearing them, and that didactic conversation is not necessary for vocabulary acquisition (Akhtar, Jipson, & Callanan, 2001). This notion is supported by cross-cultural research that describes the language acquisition of children in communities where language is rarely directed at infants and young children (Lieven, 1994). It is assumed that children in these communities learn at least some, if not a significant portion, of their language through simple exposure. This research would also suggest that increasing the amount of language input, regardless of whether it is child-directed or not, could impact child language development.

Taken together, research on early language acquisition suggests that exposure to language is important and more is better. This concept supports interventions to increase the amount parents talk to their children. Additionally, research suggests that interaction with a competent speaker may provide the most conducive environment for language acquisition, which provides support for interventions to teach parents strategies for encouraging back and forth conversation. Hart and Riley's research suggests that increasing the quantity of language input will naturally move the speech beyond directive interactions to higher quality reciprocal exchanges. Additionally, research suggests that

the quantity and quality of child-directed speech and interactions are important variables in language acquisition and clear targets for intervention aiming to enhance child language environments.

Similar to Sameroff et al. (1987), Hart and Risley (1995) demonstrated that SES is not the greatest predictor of child developmental outcomes. SES was highly correlated with vocabulary growth ($r = .65$), vocabulary use ($r = .63$), and IQ test scores ($r = .54$). However, when the five measures of parenting (language diversity, feedback tone, symbolic emphasis, guidance style, and responsiveness) were put into a single multiple regression analysis with each of the child accomplishments at age 3, the model accounted for 59% of general accomplishments as measured by the Stanford-Binet IQ test ($r = .77$) and 61% of the variance in rates of vocabulary growth and vocabulary use ($r = .78$), significantly more than SES.

It has been argued that parents living in poverty are so overwhelmed and consumed with issues of day-to-day living that they simply do not have the time or energy for language interactions with their children beyond those directed towards immediate goals (Snow, Dubber, & de Blauw, 1982). However, this has been refuted by research documenting differences in the quality of home-literacy environments *within* a sample of lower-SES families (Hart & Risley, 1995; Payne et al., 1994). Despite the economic stresses and other difficulties families living in poverty face, many still manage to engage their children in activities that stimulate language and literacy development. This research supports the idea that poverty is a marker variable and not a process variable for less enriched home-literacy environments, and it is possible even within an

impoverished environment for a parent to provide their child with necessary language and literacy experience. Furthermore, this research warrants investigation into effective interventions aimed at teaching parents the skills to stimulate their child's language and literacy development.

Home and family factors that affect child language development and are susceptible to intervention include maternal interactive style (Sameroff et al., 1987), maternal responsivity (Fewell & Deutscher, 2002; Fewell & Deutscher, 2004; Mahoney et al., 1998; Tamis-LeMonda et al., 2001), parent-child conversational features including the quantity and quality of language input (Hart & Risley, 1995; Huttenlocher et al., 1991), and frequency of parent-child shared book reading (Snow et al., 1998). Although SES is highly correlated with language outcomes, parenting behaviors account for more variance than SES, indicating that intervention to enhance parents' use of language promoting strategies could substantially impact the developmental outcomes of kids at risk due to factors associated with poverty.

Intervention Studies

A search of the literature on interventions aimed at increasing the quantity and quality of parent provided language input to young children revealed studies utilizing dialogic reading training (Whitehurst & Lonigan, 1998), milieu language training (Kaiser et al., 1998; Kaiser & Hancock, 2003), prelinguistic milieu language training (Yoder & Warren, 1998; Yoder & Warren, 2001; Yoder & Warren, 2002), enhanced milieu language training (Hemmeter & Kaiser, 1994; Kaiser & Hancock, 2003; Peterson et al., 2005), and responsive interaction training (Deutscher et al., 2006; McGowan et al.,

2008). The majority of research on child language interventions involving parents focuses on children with language and communication delays and their families (e.g., Fey et al., 2006; Kaiser et al., 1998; Kaiser & Hancock, 2003; Yoder & Warren, 1998; Yoder & Warren, 2001; Yoder & Warren, 2002). Less research is available about the effectiveness of interventions with children and families at risk for poor language outcomes due to social-environmental risk. However, the research that has been conducted with this population is promising and will be the focus of this review.

Dialogic reading, a method of reading to children where the adult reader asks the child questions and helps them to relate the story to their experience, has demonstrated robust positive effects on oral language development for a wide range of children including typically developing children (Huebner, 2000a; Whitehurst & Lonigan, 1998), those with language delays (Crain-Thoreson & Dale, 1999; Dale & Crain-Thoreson, 1996; Lonigan, Anthony, Bloomfield, Dyer, & Samwel, 1999; Valdez-Menchaca & Whitehurst, 1992), children from families of middle- to upper-SES (Arnold & Whitehurst, 1994; Whitehurst et al., 1988), and those of lower SES (Huebner, 2000b; Lonigan & Whitehurst, 1998; Valdez-Menchaca & Whitehurst, 1992). One limitation of employing dialogic reading intervention as a means of increasing parent provided language input is that it is specific to the context of shared book reading. In studies of dialogic reading the intervention sessions typically last 10- to 15-minutes (Lonigan & Whitehurst, 1998; Lonigan et al., 1999). This limits the power of an intervention aiming to substantially increase the amount of child directed adult speech, child verbalizations, and conversational turns throughout the day. Dialogic reading appears to be an effective

way to increase parent-child conversations during book reading but the intervention may not be long enough to significantly impact the quantity of language input the child receives when averaged over a whole day. Conversely, interventions that teach parents strategies they can use in multiple contexts may have larger impact. Therefore, the remainder of this review will focus on interventions aimed at altering parent-child communication more globally; teaching parents techniques that could be used in multiple contexts, and thus at higher dosages, throughout the day.

Two studies focused specifically on interventions for teenage mothers, a group considered at risk due to socio-environmental factors. McGowan et al. (2008) offered parenting sessions that focused largely on language stimulation for teenage mothers and their infants. The parenting curriculum involved three components: infant massage training, child development education, and the “You Make the Difference” (Mansolson, Ward, & Dodington, 1995) language program. The “You Make the Difference” program focused on teaching mothers strategies for stimulating and supporting their baby’s language development. Strategies included following the child’s interests, taking time to talk, combining words with gestures, and repeating words. A pre-post test comparison of infants’ scores on the Preschool Language Scale-4 indicated that those whose mothers participated in the intervention made greater gains in both receptive and expressive language scores as controls. No direct observation of mother/infant interaction was completed. Measurement of parenting behavior would be helpful in describing the effectiveness of any intervention aimed at altering parent behavior.

A second study that focused on enhancing the teenage mothers' interactions with their infants and toddlers employed a parenting curriculum that emphasized effective mother-child interaction (Deutscher et al., 2006). The intervention consisted of 24, 1-hour sessions that covered topics related to responsive parenting, mother-child interaction, and strategies for facilitating language development. Results showed intervention mothers were significantly more responsive and less directive than control mothers. Intervention mothers also scored significantly higher on the Language Facilitation Rating Scale (Deutscher & Fewell, 1998), a measure of adult behaviors that facilitate children's language acquisition. It was hypothesized that children's language performance would improve along with improved parental behaviors. Indeed, children whose mothers participated in the intervention outperformed controls on the Developmental Activities Screening Inventory-II (Fewell & Langley, 1984), a screening tool for developmental delay.

Mothers with limited cognitive ability represent another population at risk for providing their children with insufficient language stimulation. Several studies have examined the effectiveness of programs that attempt to increase positive parent-child interactions with mothers with intellectual disabilities by prompting mothers to increase physical affection and praise as well as teaching language-promoting strategies such as imitating child vocalizations (Feldman et al., 1986; Feldman et al., 1989; Feldman et al., 1993). Feldman et al. (1989) compared two teaching methods: direct teaching, which involved providing mothers with explicit instruction, followed by modeling, and feedback, compared to simply providing the parent with verbal instructions. Results

demonstrated that verbal instructions alone were not adequate to increase the mothers' use of the desired skills. However, when direct teaching was used, the interventions were successful at improving the quality of interactions amongst parent-child dyads and also at increasing child vocalizations. These results were maintained over time.

A limited number of intervention studies have examined the effects of interventions aimed at promoting language and communication development for parent-child dyads experiencing multiple risk factors. However, the research that is available in this area indicates that parents experiencing multiple social-environmental risk factors can learn to implement language promoting strategies and this has a positive impact on child language development (Bigelow, 2006; Hancock et al., 2002; Peterson et al., 2005). One study examined the effect of teaching enhanced milieu language teaching skills to families experiencing multiple risk factors (Peterson et al., 2005). This is a well-established intervention when implemented with families without environmental risk (Hemmeter & Kaiser, 1994; Kaiser & Hancock, 2003). Milieu language teaching involves the use of prompts or mands (questions, commands, or directives) by the adult to initiate a teaching episode followed by modeling of the correct response. This study employed a multiple baseline across subjects design to determine the effectiveness of individually teaching parents to use milieu language procedures. Two specific milieu techniques were taught: responsive interaction and incidental teaching. Intervention took place in the family's home and consisted of approximately 25, 1-hour training sessions. Each session consisted of a description of the skills to be learned followed by modeling by the trainer. Finally the parent practiced the skill and received feedback from the

trainer. Results of this study show an increase in parental use of milieu language techniques during intervention as well as an increase in child verbalizations. As would be expected, child verbalizations increased when parent use of milieu techniques increased. Also, the three children in this study showed increases in their mean length of utterance, a common measure of child language ability, and their standard scores on the Sequenced Inventory of Communication Development.

The results of this study indicate that milieu language techniques can be successfully taught to parents experiencing multiple risk factors and that increasing parents' use of these techniques has positive effects on child language development. Barriers to implementation associated with multiple-risk families including missed appointments, distractions in the home, difficulty completing homework, and high attrition were reported by the authors. The authors noted that the one-to-one in-home design of the intervention allowed the interventionists to form a relationship with the participant which minimized the above barriers and provided many opportunities to model milieu language procedures and provide coaching and feedback to the parent.

A second intervention study with parents and children experiencing several risk factors implemented an intervention that combined language and behavioral interventions called Blended Communication and Behavior Support (Hancock et al., 2002). This intervention package was based on enhanced milieu teaching research (Hemmeter & Kaiser, 1994; Kaiser et al., 1998) and compliance training (Forehand, 1993). Language intervention goals were similar to those described above and included providing models of appropriate language, increasing praise, and decreasing parent-provided negative

verbal responses. Intervention took place in a private room at a childcare, one-on-one with a parent educator. Consistent with the studies reviewed above, mothers were able to learn to implement the language and behavior management strategies and apply them during intervention sessions. Follow-up observations were conducted to determine the maintenance and generalization of skills learned during intervention and resulted in varied results. The authors hypothesized that generalization and maintenance may have been better if the intervention had been conducted in the home.

A third study working with parent-child dyads at risk of poor language outcomes due to social-environmental risk factors also combined a language intervention with a behavioral intervention. Bigelow (2006) examined the effectiveness of an intervention that combined the Promoting Communication Intervention (PCI) and Planned Activities Training (PAT). The Promoting Communication Intervention (PCI) was designed and evaluated by researchers at Juniper Gardens Children's Project in collaboration with early childhood educators in community-based child care settings (Harjusola-Webb, 2004; Walker et al., 2003; Walker et al., 2004; Walker, Bigelow, & Harjusola-Webb, 2006). The research base for the language promoting-strategies included in the PCI can be found in the milieu language interaction research (Yoder & Warren, 1998), incidental teaching (Hart & Risley, 1975; 1980), and responsive interaction approaches (Tannock & Girolametto, 1992). The PCI is made up of eight strategies for promoting communication including environmental arrangement, following the child's lead, commenting and labeling, imitating and expanding on child communication, asking open-ended questions, fill in the blank, praise and positive attention, and providing choices.

The effectiveness of this intervention has been demonstrated with community-based child care providers in a randomized, control-experimental group study with 100 infants and toddlers from 17 child care programs in Kansas City and Lawrence, KS. Results demonstrated that experimental group teachers used the strategies with greater frequency than the control group teachers. Furthermore, child communication was greater for children in the intervention group versus the control group.

PAT is a parenting intervention aimed at enhancing the quality of parent-child interactions by teaching parents to plan activities in advance, use positive interaction skills, and engage the child through incidental teaching strategies. The main focus of the intervention is behavior management; parents are taught to reinforce appropriate behavior while ignoring misbehavior.

Bigelow (2006) implemented the intervention with six mother-child dyads recruited through Healthy Start. Mothers' ages ranged from 19 to 20 years; child ages ranged from 9 to 35 months. All families received financial support from Temporary Aid to Needy Families (TANF) or Supplemental Security Income (SSI). Primary research questions included: Does the intervention package result in increases in parent use of language promoting strategies and PAT? Do increases in parents' use of language promoting strategies and PAT result in increases in child communication? The primary measure of the dependent variables was 30 minute observations in which data were collected on frequency of parent use of the language promoting strategies, parent responsiveness, and parent use of instructions, prohibitions, and negative statements. Frequency of child communication and parents' use of PAT was also collected. Parental

use of the language promoting strategies and PAT increased with implementation of the intervention for all families; however, this behavior was variable throughout the intervention phase. Similar to parents' use of strategies, child communication was highly variable, but overall mean child communication did increase with the implementation of the intervention. Results of this study indicated that both the PCI and PAT could be successfully taught to parents experiencing multiple risk factors, and that these changes result in an increase in parent use of language promoting strategies and a positive effect on child language development.

While this study resulted in positive outcomes on parental behavior and child language development, two important limitations exist. First, the intervention combined two independent interventions, PCI and PAT. The effectiveness of these two interventions separately with families experiencing multiple-risk factors is unknown. Second, the author noted that the intervention employed was extremely time- and labor-intensive, requiring on average six and a half months to complete. Programs that serve families experiencing multiple risk factors often run on limited resources and an intervention of this magnitude may be unrealistic. More research is needed to determine if the intervention can be pared down to increase implementation feasibility without reducing its effectiveness.

Several studies demonstrate the effectiveness of interventions to increase positive parent-child interactions and improve child language outcomes for families with children with developmental delay (e.g., Fey et al., 2006; Kaiser et al., 1998; Kaiser & Hancock, 2003; Yoder & Warren, 1998; Yoder & Warren, 2001; Yoder & Warren, 2002), teenage

mothers (Deutscher et al., 2006; McGowan et al., 2008), and mothers with limited cognitive ability (Feldman et al., 1986; Feldman et al., 1989; Feldman et al., 1993). Few studies have examined the effectiveness of such interventions with families experiencing multiple social-environmental risk factors. However, the results of intervention studies to increase the quantity and quality of parent provided-language stimulation within families experiencing multiple risk factors are generally positive, suggesting that at-risk parents can be taught strategies for promoting their child's language development (Bigelow, 2006; Hancock et al., 2002; Peterson et al., 2005). Factors associated with successful interventions for this population include one-to-one, in home programs that include opportunities for the interventionist to model desired behaviors and provide the parent with coaching and feedback (Bigelow, 2006; Feldman et al., 1989; Peterson et al., 2005).

Language Environment Analysis

The Language ENvironment Analysis (or LENA) system was developed by researchers inspired by Hart and Risley's (1995) study that demonstrated the importance of early language input on later intellectual and language development. The LENA system provides researchers with an automated way to collect data on three key aspects of the child's natural language environment: 1) Adult Word Count, an estimate of the number of adult words spoken near the target child per hour; 2) Child Vocalizations count, defined as child speech of any length surrounded by 300 ms of silence; and 3) Conversational Turns, defined as a speech segment, involving the target child and another person, of any length separated by less than 5 seconds of silence or non-speech noise (Gilkerson & Richards, 2009). Before LENA, collecting this type of data required human

coders and transcribers and therefore limited the quantity of data that could be obtained. LENA provides a way for researchers to analyze the natural language environment of children throughout the day. This technology opens the door to research that would not be possible when relying only on observers.

Most of the research conducted using LENA to this point has been descriptive and correlational. The LENA Foundation conducted a large norming study in which they replicated Hart and Risley's main finding: children who receive more parent provided language input have more advanced language skills than their peers who receive less language input (Gilkerson & Richards, 2009). The LENA Foundation norming study also confirmed Hart and Risley's finding that the amount of talk correlates with SES. The LENA Foundation used attained education as a proxy for SES and concluded that on average parents with a bachelor degree or higher spoke more to their children than parents who had not obtained a bachelors degree. The LENA Foundation has conducted other descriptive research examining factors that contribute to the amount of language input children receive such as the effects of gender, birth order, and television exposure (Gilkerson & Richards, 2009). A limited number of independent research studies have been conducted using LENA. Zimmerman et al. (2009) discussed in the above review, used LENA to evaluate the impact of adult word count, conversational turns, and television exposure on child PLS-4 scores. That study demonstrated that the number of conversational turns has the greatest impact on child language development. A population-based study of the effect of audible television on adult words, infant vocalizations, and conversational turns also utilized LENA and concluded that audible

television is associated with a decrease in adult speech and a decrease in child vocalization (Christakis et al., 2009).

Many possible applications of the LENA system exist. One possible application is to use the information gathered to help parents enhance the language environments they provide their children. The LENA Foundation conducted some preliminary research that supports the notion that parents will increase the amount of language input they provide when given feedback. They provided 102 families with LENA systems and asked them to record weekly and try to improve the amount they talked to their children. The participants used the LENA system independently, downloading the recordings onto their personal computers and using the data to monitor their progress. Over 13 weeks parents were able to increase the amount they talked. On average, parents who started below the 20th percentile increased by 33%. Those who started between the 20th and 80th percentile increased, on average, by 17% (Gilkerson & Richards, 2009). This research provides preliminary evidence that feedback from the LENA systems may help adults change their behaviors and enhance their children's language environments.

The LENA system also may prove to be useful for monitoring the effects of interventions. The LENA Foundation provides a few case studies where they demonstrated increases in adult word count during behavior therapy for a child with autism. The LENA system shows great potential as an efficient tool for monitoring, evaluating, and improving the language environments of children. More research is needed to examine the utility of the LENA as an intervention tool as well as for analyzing

the effectiveness of interventions aimed at enhancing the language environments of children.

Critique of the Literature

Research clearly demonstrates the correlation between SES and academic achievement (National Center for Educational Statistics, 1998) and the need for early intervention to decrease the discrepancy in achievement by social class (Shonkoff & Pianta, 2000; Vernon-Feagans et al., 2001). The achievement gap between children of lower and upper SES is present at school entry and widens throughout the years of schooling (Francis et al., 1996; Hamre & Pianta, 2005; Whitehurst & Lonigan, 2001). Home literacy environment and preschool language and literacy ability are highly correlated (e.g., Beals et al., 1994; see review by Bus et al., 1995). Therefore, interventions aimed at decreasing the achievement gap should begin early and involve families to maximize the likelihood of having a substantial impact.

More research is needed to determine the most effective and efficient ways to enhance the language environments of children experiencing multiple social-environmental risk factors. Research demonstrates the importance to children's early language environment on their future intellectual and academic success. Research has also shed light on the key variables that impact child language development: the amount of language input and the number of opportunities for reciprocal conversations. However, research on effective ways to increase the amount of language input and the number of opportunities for reciprocal conversations is still lacking. Interventions that effectively enhance the home-language environment of young children could potentially have a large

and sustained impact. Furthermore, intervention research will help shed light on the processes through which early language input affects later developmental outcomes. To this point all the research that suggests early language environments are important is correlational. Intervention research will allow us to determine if a causal relationship exists.

In addition to the limited number of studies on this topic, two primary weaknesses in the current literature base exist. First, the majority of the research in this area focuses primarily on measuring parents' use of language-promoting strategies taught during intervention. The measurement of language-promoting strategies is generally completed during discrete observations of parent behavior, making conclusions about the generalization of behaviors outside of observations difficult. From this data, conclusions about how much the intervention affected the amount of talk occurring between the child and parent throughout the day cannot be drawn. Advances in technology, such as the Language ENvironment Analysis (LENA) system, may provide interventionists with an avenue to more complete data on the language environments of young children. These data can be collected in the home while the parent and child go about their typical day. This approach provides more naturalistic data and possibly the ability to measure the generalization of skills taught during intervention. Research is needed to determine the effectiveness of LENA as an intervention tool as well as a measurement technique.

Second, feasibility of implementation, both for the families and for programs that may seek to implement interventions on a large scale, has not been adequately considered. Many authors have noted the barriers encountered when working with

families experiencing multiple risk factors (e.g., Bigelow, 2006; Peterson et al., 2005), but little is known about the most effective ways to customize interventions to meet the unique needs of this population. Programs hoping to have a substantial impact on parent behavior and child outcomes must not only be supported by theoretical and empirical rigor but must also be feasible for families experiencing multiple risk factors (Greenwood et al., 1992; McConnell, 1994). Impact can be described as a function of both an intervention's efficacy and the breadth and fidelity of its implementation (McConnell, Wackerle, & Bradfield, 2008). That is, a highly effective intervention will have no impact if it is never implemented or implemented incorrectly. Research is needed to examine strategies that circumvent barriers to interventions that often reduce the effectiveness of otherwise effective interventions. Further, interventions are needed that effectively increase the quality and quantity of parent-child interactions and can be feasibly implemented within large-scale, cost-effective programs.

The goal of the present study was to determine the effectiveness of an intervention to enhance the quantity and quality of parent-child language interactions among families with multiple social and environmental risk factors. Two levels of intervention were evaluated to determine the intensity of intervention needed to increase the amount of language input participating parents provide their young children. The effect of increased parent-provided language input on the numbers of child vocalizations and parent-child conversations was also analyzed.

Research Questions

1. Does parent education about the importance of talk in conjunction with graphical

feedback increase parent-provided child language input?

2. Does conducting the Promoting Communications Intervention with parent-child dyads, which includes direct in-home parent training of language promotion strategies, increase the amount of parent-provided language input beyond that of parent education and graphical feedback alone?
3. Does increasing parent-provided language input increase child vocalizations? Is there a differential effect on child vocalizations between Phase 1 and Phase 2 of intervention?
4. Does increasing parent-provided language input increase conversational turns in a parent-child dyad? Is there a differential effect on conversational turns between Phase 1 and Phase 2 of intervention?
5. If increases occur in adult word count, child vocalizations, and/or conversational turns, do these increases maintain?

Chapter 3

Methods

Participants

Four parent-child dyads participated. They were recruited through local agencies that provide services to families. Eligibility criteria included having a primary caregiver home with the child the majority of the day, having a child between the ages of 18 and 48 months, and exhibiting low levels of parent-child language interaction based on initial LENA recordings. All participants were monolingual, English speaking families who were chosen by a home-visiting staff member of recruiting agencies as a family that may benefit from this intervention. All four dyads consisted of child and biological mother. All families had multiple children. The family of dyad 1 consisted of three other children ranging in age from 14-20 years. The family of dyad 2 included one other child who was an infant. The family of dyad 3 included one older daughter who was 15-years-old. The family of dyad 4 included an infant brother. All mothers were home with their child the majority of the day at the start of the study. One child attended part-day preschool; the rest received no organized out-of-home care. All families were living below the Federal Poverty Line and receiving assistance through Minnesota Family Improvement Plan and/or Temporary Assistance for Needy Families. Child age ranged from 25 to 34 months at the beginning of intervention. Mother's age ranged from 21 to 35 years (see Table 1).

Children's expressive language development was assessed at baseline for descriptive purposes. The LENA Automatic Vocalization Assessment (AVA; Gilkerson

& Richards, 2009) and MacArthur-Bates Communicative Developmental Inventory (CDI; Fenson et al., 2007) were used. Estimated Mean Length of Utterance ranged from 1.83 to 2.62 words. Percentile rank based on the Automatic Vocalization Assessment ranged from the 24th to 55th percentile. Percentile Rank based on the CDI Vocabulary Checklist ranged from <5th percentile to the 45th percentile (see Table 2).

Table 1

Demographic Information

	<i>Dyad 1</i>	<i>Dyad 2</i>	<i>Dyad 3</i>	<i>Dyad 4</i>
<i>Mother</i>				
Age (years)	35	28	35	21
Race	African-American	African-American	African-American	African-American
Marital Status	Married	Living with Partner	Single	Single
Other Children	16-and 20-year-old sons; 14-year-old daughter	3-month-old son	15-year-old daughter	Newborn son
Highest Grade Completed	Some College	Some College	High School	Some College
<i>Target Child</i>				
Age (months)	34	26	25	33
Gender	Male	Male	Female	Male
Race	African-American	African-American	African-American	African-American
Parental Concerns about health and/or development	None	Hearing and Speech	Speech	Speech

Table 2

Children's Baseline Language Scores

	<i>Dyad 1</i>	<i>Dyad 2</i>	<i>Dyad 3</i>	<i>Dyad 4</i>
<i>LENA AVA</i>				
EMLU	2.62	1.97	1.83	2.32
Percentile Rank	46 th	55 th	36 th	24 th
<i>McArthur-Bates CDI</i>				
Vocabulary Checklist	10 th	45 th	<5 th	15 th
Percentile Rank				

Note: Percentile ranks compared to same-aged, same-gender peers; LENA=Language Environment Analysis, AVA=Automatic Vocalization Assessment; EMLU=Estimated Mean Length of Utterance

Measures

Demographic questionnaire. Parents were asked to complete a demographic questionnaire containing questions about ethnicity, marital status, income, education, employment, number of family members living in the home, health and disability status of the child, mothers concerns about the child's health and development, and services the family is receiving. Parents completed the demographic questionnaire during baseline and had an opportunity to update the form post-intervention (see Appendix A).

Activities survey. Parents completed a survey assessing their perception of the importance of various activities such as reading to their child or asking their child questions. Parents first rated each activity on a Likert-type scale ranging from unimportant to very important. Next, they were asked to rank-order activities in order of importance. This survey was completed pre- and post-intervention to assess changes in parents' perceived importance of talking to their child (see Appendix B).

Language ENvironment Analysis (LENA). The LENA system consists of a digital language processor (DLP) and speech recognition software and is used to record and analyze the amount of talk occurring in a home. Children wear the DLP in the pocket of custom-made clothing and the system records all audio data occurring in the home for up to 16 hours. The data collected on the DLP is then downloaded into the speech recognition software which segments the audio file into adult and child sounds and eliminates background noise, overlapping speech, unclear speech, electronic media sounds, and child non-speech sounds. A language-dependent statistical model is then used to estimate the number of adult words spoken in each segment. Finally, child sound segments are run through statistical analysis to detect vocalizations and filter out laughing, crying, and vegetative sounds. The speech recognition software provides 3 key reports including Adult Word Count (AWC), Child Vocalizations (CV), and Conversational Turns (CT: Gilkerson & Richards, 2009).

Adult word count. AWC is an estimate of the number of adult words spoken near the target child per hour. To estimate the reliability of the LENA System at detecting AWC, the LENA Foundation compared AWC scores as measured by the LENA system to those collected by human transcribers on 70 independent 12-hour long audio files. A significant linear correlation was found between human and LENA AWC estimates ($r=.92$, $p<.01$) with the LENA system mean word count on average being 2% less than that of the human transcribers (Xu, Yapanel, & Gray, 2009).

AWC was used to determine eligibility to participate in the intervention, provide parents with data on the amount of language input they were providing, and to measure

the effectiveness of the present intervention at increasing adult provided language input. AWC was also used as the phase change criterion for this study. Phase changes occurred once AWC data presented modest variation in level and slope.

Child vocalizations. CV was defined as child speech of any length surrounded by 300 ms of silence. LENA-based algorithms are designed to distinguish between key child speech (words, babbles, and pre-speech communication) and key child non-speech (fixed signals such as cries, screams, laughing and vegetative sounds).

To assess the accuracy of the LENA system at distinguishing child speech from non-speech the LENA data was compared to that of human transcribers for 70 test set files. LENA algorithms correctly detected 75% of the human-identified child vocalizations and 84% of non-vocalizations. The LENA system misclassified only 16% of non-vocalizations and vocalizations (Xu et al., 2009).

CV was used to measure the effect of increasing adult-provided language input on child communication.

Conversational turns. The LENA system also provides a measure of the frequency of CT. A conversation is defined as a speech segment involving 2 or more people of any length separated by 5 seconds or less of silence or non-speech noise. For example, conversation between a parent and a child consisting of adult-child-adult-child would include 2 CT.

Reliability and validity data specific to CT are not available. The publishers state that CT reliability and validity is demonstrated by the data that support the reliability and validity of AWC and CV as CT is just the detection of consecutive AWC and CV.

CT was used to measure the effect of the intervention on the number of CT that occurred between the target child and an adult.

Automatic vocalization assessment. The LENA system provides an Automatic Vocalization Assessment (AVA) which automatically measures a child's expressive language based on recordings from the child's natural environment. AVA provides Standard Score, Developmental Age, and Estimated Mean Length of Utterance (EMLU) with reliability comparable to that of typical clinical assessments such as the Receptive-Expressive Emergent Language Test (REEL) and Preschool Language Scale-4 (PLS-4).

Test-Retest reliability for averaged AVA standard scores collected one month apart are highly correlated ($r=.85, p<.01$). Developmental age estimates were similarly reliable ($r=.99, p<.01$). Validity of AVA estimates was examined by correlating AVA standard scores to expressive language index scores collected by the PLS-4 and REEL-3. Averaged AVA scores correlated with averaged expressive language index scores well ($r=.77-.80, p<.01$). Correlations between AVA developmental age estimates correlated highly with chronological age estimates on the PLS-4/REEL-3 ($r=.97, p<.01$). EMLU validity was examined by correlating EMLU and actual MLU scores ($r=.78, p<.01$). Participant AVA scores were used to describe their language skills at the onset of the study.

The normative phase of the LENA Natural Language Study was conducted between January 2006 and June 2006 (Gilkerson & Richards, 2009). A total of 329 typically developing infants and toddlers from monolingual English-speaking households were recruited from the Denver-metro area. The normative phase participant pool was

representative of the US Census with respect to mother's attained education (e.g. 24% college degree, 29% some college, 24% high school diploma, 23% high school drop outs). Participants were sent LENA DLPs in the mail and provided day-long audio recordings of their natural language environment once a month. Parents did not receive feedback from the recordings sessions.

MacArthur-Bates Communicative Developmental Inventory. The MacArthur-Bates Communicative Developmental Inventory (CDI) is a parent- or caregiver-completed questionnaire, which measures the language and communication skills of children 8 to 37 months of age (Fenson et al., 2007). The CDI typically takes 20-40 minutes to complete and comes in three versions depending on the child's age. The CDI: Words and Gestures form is for children 8-18 months and prompts parents to document the child's understanding of hundreds of early vocabulary items separated into semantic categories such as animal names, household items, and action words. The second part of the CDI: Words and Gestures contain questions about the communicative and symbolic gestures the child has tried or completed.

The CDI: Words and Sentences form is for use with children ages 16–30 months. Like the CDI: Words and Gestures, parents document the child's production and use of hundreds of words divided into semantic categories. The second part analyzes the early phases of grammar, including the child's understanding of word forms and the complexity of the child's multi-word utterances. Parents identify the words the child has understood or used and provide written examples of the child's three longest sentences.

The CDI-III is an extension of the CDI for children 30–37 months of age. The first component is a 100-item vocabulary checklist (including 45 words from the CDI: Words and Sentences and 55 new words). The second component consists of 13 questions about the child's word combinations (including five drawn from the CDI: Words and Sentences and seven new items developed to reach the appropriate difficulty level). The third and final component consists of 12 yes/no questions asking about various aspects of comprehension, semantics and syntax.

The CDIs were normed on approximately 1,800 children in three locations. Studies of the CDI have shown that it is a valid and reliable measure for typically developing children (Dale, Bates, Reznick, & Morisset, 1989; Dale, 1991) and children with delays in early language development (Heilman, Ellis Weismer, Evans, & Hollar, 2005; Thal & Bates, 1988). Correlations between the CDI vocabulary scores and comparable measures of vocabulary are moderate to high. For example, Dale (1991) demonstrated that the CDI words produced measure is highly correlated with Mean Length of Utterance ($r=.68$), Expressive One-Word Picture Vocabulary Test (EOWPVT; $r=.73$), and the Stanford-Binet memory for sentences ($r=.75$). Similar correlations were found for sentence complexity and maximum sentence length.

In the current study the CDI was used to describe participants' language skills at the onset of the study.

Parent satisfaction questionnaire. A brief parent satisfaction questionnaire was completed by the parent participants following intervention (see Appendix C). This 29-item questionnaire was based off of the Talk to Me Parent Feedback form (Bigelow,

2006) and utilized a 5-point Likert scale to capture parent perceptions about the Intervention. Four questions were added to the original form to include questions pertaining to Phase 1 of intervention. Parents were asked to rate various aspects of the intervention including activities they found useful, outcomes of the project, and the home visitor/researcher. Additionally, open-ended questions such as “what part of this project did you find most helpful” were asked.

Procedures

Recruitment. Recruitment was facilitated by Way to Grow and Reuben Lindh Family Services. Home visitors were briefed on the program and contacted families they thought met the criteria for participation. They provided the families with information about the program and if they were interested scheduled a meeting with the principal investigator (PI). During the initial meeting the PI provided the potential participant with further details about the program. If they wanted to participate the consent was completed and a date for the initial data collection was scheduled.

Participants recruited through Way to Grow were receiving monthly home visits from a Family Educator. Way to Grow’s mission is to empower parents to be their children’s first teachers, stressing the importance of early education and being ready for kindergarten. Participants recruited through Reuben Lindh Family Services were receiving family support services, which included in-home case management, parenting education and support, and community resource support.

Confirm eligibility. A preliminary 10-to 12-hour LENA recording was completed to estimate the baseline Adult Word Count (AWC) level in the home. AWC

had to be below the 20th percentile during the initial data collection to qualify to participate. Dyad 1, 2, and 4 all fell below the 20th percentile on the initial 10-to 12-hour data collection, falling at the 17th, 1st, and 8th percentiles respectively. Dyad 3 had a preliminary AWC at the 41st percentile; however, the majority of the adult words were between 9:00pm and 11:00pm due to visitors. Follow-up recordings revealed a low level of AWC when just mother and child were home. The average hourly AWC during baseline was 571 words, below the 20th percentile. The initial data collection consisted of a 12-hour LENA recording that allowed the PI to get an estimate of the AWC level in the home.

Baseline. Baseline data were collected before any training or explanation beyond that required for the consent was provided to the participant. Baseline included a minimum of 3 data points and continued until a stable baseline was established. Duration of baseline ranged from 1 to 3 weeks. Data were collected using the LENA system approximately three times per week for a 10-to 12-hour period. The investigator delivered a DLP to each participating family prior to each baseline session, started the DLP, and collected the DLP the day following each baseline session. Other than incidental contact, no intervention was provided during this phase.

Once several baseline data points were collected and a stable trend was observed, the primary investigator worked with the parents to choose a 2-hour block of time in which they would implement the intervention. The 2-hour target time was chosen based on the following criteria: the child was typically awake, parent and child were typically home and together, and the parent was available to interact with the child. Data from this

2-hour block was parceled out of the longer data collection period, converted to rate per hour, and graphed as baseline data points.

Phase 1: Information plus graphical feedback. Phase 1 began with a home visit in which the PI talked to parent about the importance and benefits of talking to young children (see Appendix E for handout provided to parents). During this meeting the PI also spoke with the parent about the LENA system and the data that had been collected during baseline. The PI brought the daily graphs provided by the LENA system as well as the graphs depicting the rate of AWC, CV, and CT over the proposed 2-hour target time. The PI and parent discussed the current level of language input the target child was receiving and set a goal to increase the amount of talking during the next data collection. The goal for all four families in Phase 1 was to get above the 50th percentile.

Following this introductory session, parents continued their three-times-per week sessions following the same procedures as in baseline. The PI downloaded the LENA data and generated progress graphs between each visit. Twice per week the most current data available was shared with the parent. Together the PI and parent discussed their progression toward their goal and set a goal for that day's target time (see Appendix D for detailed description of session). Phase 1 sessions typically lasted 10 to 20 min. Weeks in Phase 1 ranged from 2 to 5 weeks.

Phase 2: Graphical feedback plus parent training. Once AWC appeared to stabilize, intervention Phase 2 began. Phase 2 consisted of continuing to provide graphical feedback using the LENA system and conducting parent training in language promotion strategies using the Promoting Communication Intervention (PCI) designed

and evaluated by researchers at Juniper Gardens Children's Project in collaboration with early childhood educators in community-based child care settings (Harjusola-Webb, 2004; Walker et al., 2003; Walker et al., 2004; Walker et al., 2006). A version of this intervention has also been successfully implemented with parents experiencing socio-environmental risk factors in conjunction with Planned Activities Training (Bigelow, 2006).

The PCI draws upon research-based techniques discussed in the literature on responsive interaction (Tannock & Girolametto, 1992), milieu language strategies (Yoder & Warren, 1998), and incidental teaching (Hart & Risley, 1975; Hart & Risley, 1980). The language-promotion techniques utilized in the intervention include environmental arrangement, following the child's lead, commenting and labeling, imitating and expanding on child communication, asking open-ended questions, fill in the blank, praise and positive attention, and providing choices.

Training was conducted in the home with the PI, parent, and child present. During the first meeting within Phase 2 the PI provided the parent with an overview of the PCI: reviewing the purpose of the intervention, explaining why promoting communication is important, and discussing how these strategies can be incorporated into daily routines. Strategies taught over the course of this treatment phase included: arranging the environment, following a child's lead, commenting and labeling, imitating and expanding, open-ended questions, praise and positive attention, providing choices, and time delay/fill in the blank. Phase 2 sessions typically lasted 20 to 30 min.

One strategy was introduced per session with the exception of the first session in

which three strategies were taught: arranging the environment, following the child's lead, and commenting and labeling. These strategies are generally taught together in the first session because arranging the environment and following the child's lead are foundational principles that get reiterated throughout the intervention. Each strategy was taught in the same way: 1) watch the video segment for that strategy which provides an explanation of what the strategy is, why it is important, and ways to implement it; 2) PI discussed with parent specific ways to use the strategy during the 2-hour target time; 3) If the child was available the PI modeled the strategy for the parent. Subsequent sessions included a review of previously learned strategies, an opportunity for the parent to ask questions, and then the training of the next strategy. This continued until all strategies had been taught.

Parents were also given a manual that contained information on each strategy and ways to incorporate that strategy into play activities, daily routines, and book activities (see Appendix F). Throughout Phase 2 the PI continued to bring the LENA graphs as well as the graphs depicting the rate of AWC, CT, and CV during the 2-hour target time. Progress was reviewed two times per week and participants were encouraged to continue to increase, or maintain if they had reached an acceptable level, the language input they provided their child. Weeks in Phase 2 ranged from 2 to 3 weeks.

Parent-completed questionnaires and assessments. The parent completed the demographic questionnaire during baseline. They completed the activities survey and MacArthur-Bates Communicative Development Inventory during the first session of Phase 1. Following the completion of the intervention parents completed the activities

survey again and updated the demographic questionnaire if necessary.

Implementation Fidelity. Intervention sessions were recorded using a digital audio recorder to permit for implementation fidelity checks. Fidelity of implementation was assessed using a checklist of essential components of the intervention. Separate checklists were created for Phase 1 and Phase 2 (see Appendix F). Each component heard on the audio recording earned one point. Percent fidelity was calculated by summing total essential components heard, dividing by the total essential components, and then multiplying by 100.

A research associate at the Center for Early Education and Development at the University of Minnesota listened to a sample of the recordings and completed the fidelity checklist. A total of 17 intervention sessions were recorded. Two dyads only had one recorded session due to technological glitches. Those sessions were included in the fidelity check as well as two randomly selected sessions from each of the other two participants. A total of six intervention sessions were checked, three Phase 1 and three Phase 2 sessions. Fidelity of implementation of essential features was 100%.

Experimental Design

A multiple baseline across participants, replicated across two pairs was employed to evaluate the effect of the two intervention packages at increasing AWC and consequently increasing CV and CT. Phase change criteria were based on stability of level and trend of AWC. Intervention Phase 1 was introduced initially to one dyad in each pair. When an increase in AWC was observed the second dyad entered Phase 1.

Phase 2 was introduced once stability in level and trend of AWC was observed, again beginning with dyad 1 and followed by dyad 2.

Data Analysis

Data Analysis was conducted through visual inspection of graphically depicted data and computation of Percentage of Data Points Exceeding the Median (PEM). Each data point represented the rate (calculated over 2 hours of data collection) of AWC, CV, and CT. Changes in level and trend across phases provide evidence of an intervention effect. Replicated effects across participants provide evidence of a significant effect of intervention on AWC, CV, and/or CT. Missed or excluded data points are indicated on graphs as a missing point for that session. Data points were excluded if the parent indicated they did not complete the 2-hour target period that day.

PEM was computed following the guidelines outlined in Ma (2006). Criteria for judging the size of the effect are as follows: PEM of 90% or higher indicates highly effective, 70% to less than 90% indicates a moderate effect, 50% to less than 70% represents mild or questionable effect, and below 50% indicates an ineffective treatment.

Chapter 4

Results

The goal of the present study was to determine the effectiveness of an intervention to enhance children's home-language environments. Two levels of intervention were evaluated to determine the intensity of intervention needed to increase the amount of language input participating parents provided their young children. Additionally, the effect of intervention on the quantity of Child Vocalizations (CV) and Conversational Turns (CT) was assessed. Primary research questions included: 1) Does parent education about the importance of talk in conjunction with graphical feedback increase parent-provided child language input? 2) Does conducting the Promoting Communications Intervention (PCI) with parent-child dyads, which includes direct in-home parent training of language promotion strategies, increase the amount of parent-provided language input beyond that of parent education and graphical feedback alone? 3) Does increasing parent-provided language input increase Child Vocalizations (CV)? Is there a differential effect on CV between Phase 1 and Phase 2 of intervention? 4) Does increasing parent-provided language input increase Conversational Turns (CT) in a parent-child dyad? Is there a differential effect on Conversational Turns (CT) between Phase 1 and Phase 2 of intervention? 5) If increases occur in Adult Word Count (AWC), CV, and/or CT, do these increases maintain?

To address the primary research questions, data on the key dependent variables were converted to rates over the 2-hour target time, graphed, and visually analyzed. Changes in level, trend, and variability were considered. Additionally, the percentage of

data exceeding the median (PEM) was computed. Means and ranges for each dyad within each phase as well as overall means and ranges are provided.

Research question 1: Does parent education about the importance of talk in conjunction with graphical feedback increase parent-provided child language

input? To answer this question rate of AWC from baseline to Phase 1 was analyzed.

Baseline for Dyads 1, 3, and 4 was relatively low and stable. Dyad 2 had a slight accelerating trend after three low and stable data points. Visual inspection of data from baseline to Phase 1 shows an increase in the level of AWC for all dyads (see figure 1). Dyads 1, 2, and 4 experienced a strong effect with 100% of Phase 1 data exceeding the baseline median. Dyad 3 experienced a moderate effect with 83% of Phase 1 data exceeding the baseline median (Ma, 2006; see table 3). All families showed a significant increase in the averaged rate of AWC from baseline to Phase 1 (see Table 4).

Table 3

Percentage of Data Exceeding the Median

<i>Dyad</i>	<i>Adult Word Count</i>		<i>Child Vocalizations</i>		<i>Conversational Turns</i>	
	<i>Phase 1</i>	<i>Phase 2</i>	<i>Phase 1</i>	<i>Phase 2</i>	<i>Phase 1</i>	<i>Phase 2</i>
1	100%	75%	89%	75%	89%	100%
2	100%	100%	89%	67%	89%	100%
3	83%	50%	67%	100%	100%	75%
4	100%	40%	67%	20%	67%	17%

Note: Phase 1 Percentage of Data Exceeding the Median (PEM) scores represent the percentage of Phase 1 data that exceeds the median of baseline. Phase 2 PEM scores represent the percentage of Phase 2 data that exceeds the median of Phase 1.

Research question 2: Does conducting the Promoting Communications

Intervention with parent-child dyads, which includes direct in-home parent training of language promotion strategies, increase the amount of parent-provided language

input beyond that of parent education and graphical feedback alone? Visual inspection of AWC data from Phase 1 to Phase 2 shows a mixed effect. Dyad 1 had a strong response to Phase 1 of intervention, increasing AWC to an average of 1475 words per hour; however, the day-to-day variability of AWC in Phase 1 was great. Phase 2 resulted in a decrease in variability, with all Phase 2 data points remaining above the 50th percentile based on LENA norms. Dyad 2 data also showed a decrease in variability with the onset of Phase 2, all Phase 2 data points are at or above the 50th percentile compared to only a third of Phase 1 data points. A clear distinction in level, trend, or variability between Phase 1 and 2 in terms of AWC is not evident for Dyads 3 and 4 (see Figure 1).

PEM scores support this visual inspection conclusion, indicating a moderate effect of intervention for Dyad 1 (PEM=75%), strong effect for Dyad 2 (PEM=100%), and no added effect of Phase 2 on AWC for Dyads 3 and 4 (PEM=50% and 40% respectively). The averaged rates of AWC from Phase 1 to 2 show a modest increase for three out of four families. Averaged AWC for Dyad 4 remained relatively stable (see Table 4).

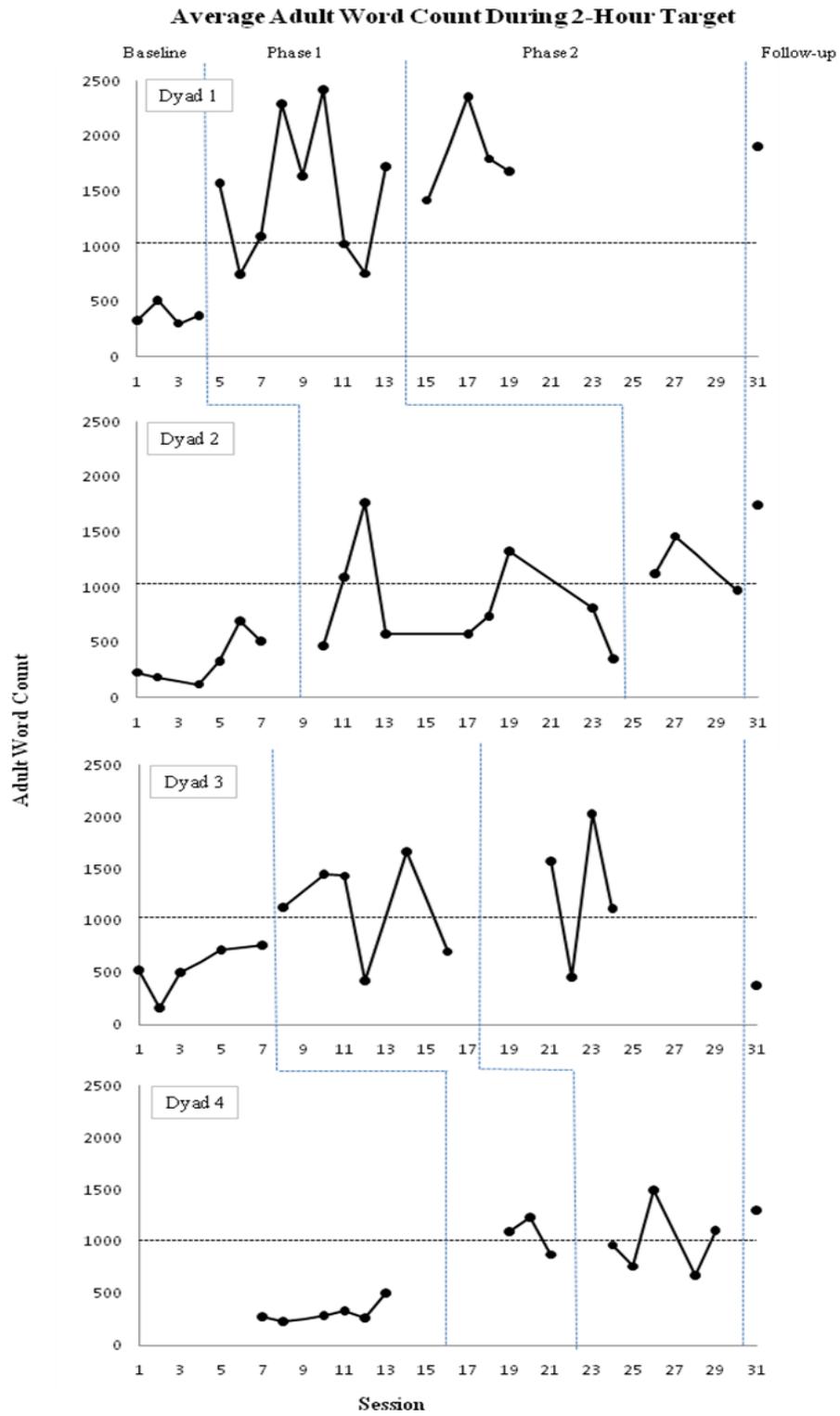


Figure 1. Multiple baseline across dyads representing Adult Word Count. Dashed horizontal line represents the 50th percentile based on LENA normative study.

Table 4

Mean Frequency and Range of Adult Word Count during 2-Hour Target Time

Dyad	Baseline	Phase 1	Phase 2	Follow-Up
1	379 (302-514)	1475 (747-2295)	1812 (1417-2356)	1908
2	347 (120-697)	856 (355-1796)	1187 (977-1462)	1744
3	574 (161-763)	1133 (423-1663)	1294 (458-2028)	375
4	314 (228-498)	1066 (871-1231)	999 (669-1495)	1296
Combined	404	1133	1323	1331

Research question 3: Does increasing parent-provided language input increase CV? Is there a differential effect on CV between Phase 1 and Phase 2 of intervention? Visual inspection of CV data indicates a moderate increase in CV for 3 out of 4 families. The general pattern of response was an increase in variability during Phase 1 and a relatively high and stable trend in Phase 2. Dyad 1 data showed an initial increase in CV after the introduction of Phase 1; however, a decreasing trend occurred after the fourth Phase 1 data point. With the onset of Phase 2 of intervention, CV decreased in variability and recovered to a level above the 50th percentile.

Dyad 2 data showed an increase in CV from baseline to Phase 1 and Phase 1 to Phase 2, but the data are highly variable. Baseline CV for Dyad 2 was variable and relatively high, remaining around the 50th percentile. Phase 1 data do not illustrate a clear increase in level, but an increase in variability is evident with data points ranging from 43 vocalizations per hour to 557 vocalizations per hour. Again Phase 2 is marked with a decrease in variability, with all data points in Phase 2 remaining above the 50th percentile.

Dyad 3 had a highly variable baseline followed by a similarly variable Phase 1. Level of CV remained stable from baseline to Phase 1. Dyad 3 showed a strong response to Phase 2 with stable data points well above the median of Phase 1.

Finally, visual inspection of Dyad 4 CV data showed a weak response to either Phase 1 or Phase 2 of intervention. An initial increase in CV occurred with the onset of Phase 1 but was followed immediately by a decreasing trend. CV data in Phase 2 were stable and low (see Figure 2).

Similar to visual inspection, PEM data indicated a moderate effect of Phase 1 on CV for Dyads 1 and 2 (PEM=89%) but a weak effect for Dyads 3 and 4 (PEM=67%). Phase 1 to Phase 2 PEM analysis indicated mixed results; a moderate effect for Dyad 1 (PEM=75%), a weak effect for Dyad 2 (PEM=67%), a strong effect for Dyad 3 (PEM=100%), and no effect for Dyad 4 (PEM=20%). Averaged rates of CV from baseline to Phase 1 and Phase 1 to Phase 2 show a step-wise increase for 3 out of 4 families (see Table 5).

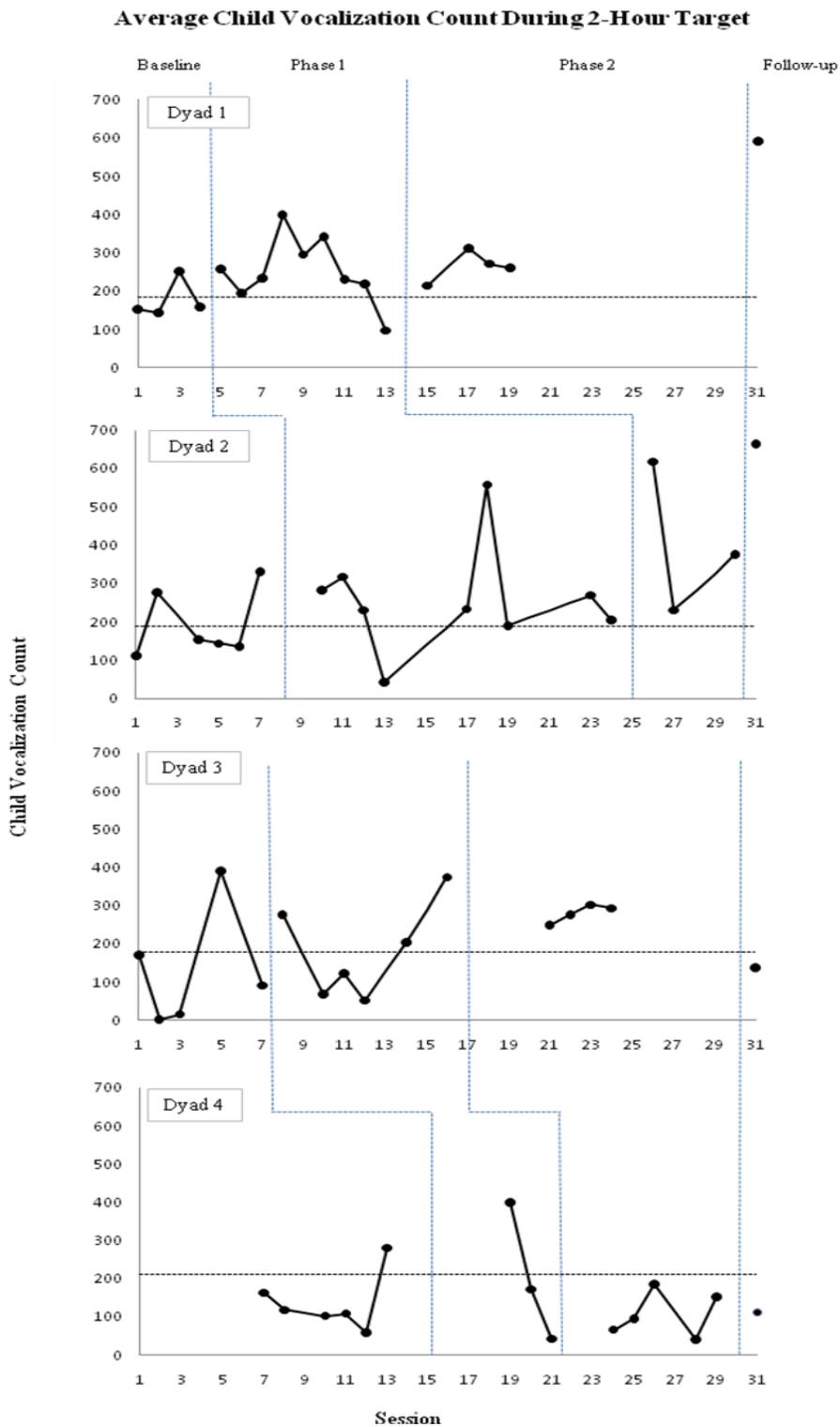


Figure 2. Multiple baseline across dyads representing Child Vocalizations. Dashed horizontal line represents the 50th percentile based on LENA normative study.

Table 5

Mean Frequency and Range of Child Vocalizations during 2-Hour Target Time

Dyad	Baseline	Intervention Phase 1	Intervention Phase 2	Follow-Up
1	177 (144-253)	252 (97-399)	264 (214-312)	592
2	192 (111-330)	258 (43-557)	408 (230-618)	664
3	134 (1-390)	183 (51-374)	280 (248-302)	138
4	138 (58-280)	204 (42-399)	108 (41-186)	112
Combined	160.25	224.25	265	377

Research question 4: Does increasing parent-provided language input increase CT in a parent-child dyad? Is there a differential effect on CT between Phase 1 and Phase 2 of intervention? Visual inspection of CT graphs showed a modest to strong effect for 3 of 4 dyads. CT data for Dyad 1 looked very similar to their CV data with an initial increase in CT with the onset of Phase 1 and then a decreasing trend midway through the first phase. Phase 2 for Dyad 1 resulted in an initial level recovery, restricted variability, and indications of an increasing trend.

Dyad 2 showed a slight increase in level and variability from baseline to Phase 1. Phase 1 to Phase 2 data showed an obvious initial increase with the remaining two data points staying above the median of Phase 1.

Dyad 3 had a variable baseline making visual inspection more difficult; however, if the initially low and stable data points are attended to, it is clear that there is an increase in level from baseline to Phase 1. Phase 2 resulted in a slightly higher and less variable data.

Finally, Dyad 4 showed an initial increase with the onset of Phase 1 but a

decreasing trend ensued. The introduction of Phase 2 resulted in a slight increase but fell again midway through Phase 2 (see Figure 3).

PEM scores from baseline to Phase 1 indicated a moderate effect for Dyads 1 and 2 (PEM=89%), a strong effect for Dyad 3 (PEM=100%), and a mild effect for Dyad 4 (PEM=67%). Interestingly, there was a strong effect of Phase 2 compared to Phase 1 for Dyads 1 and 2 (PEM=100%) and a moderate effect for dyad 3 (PEM=75%), indicating that Phase 2 added value to Phase 1 in terms of increasing the number of dyadic verbal exchanges. Examination of averaged rates shows an increase in CT for all families from baseline to Phase 1. Three out of 4 families showed an increase from Phase 1 to Phase 2 (see Table 6).

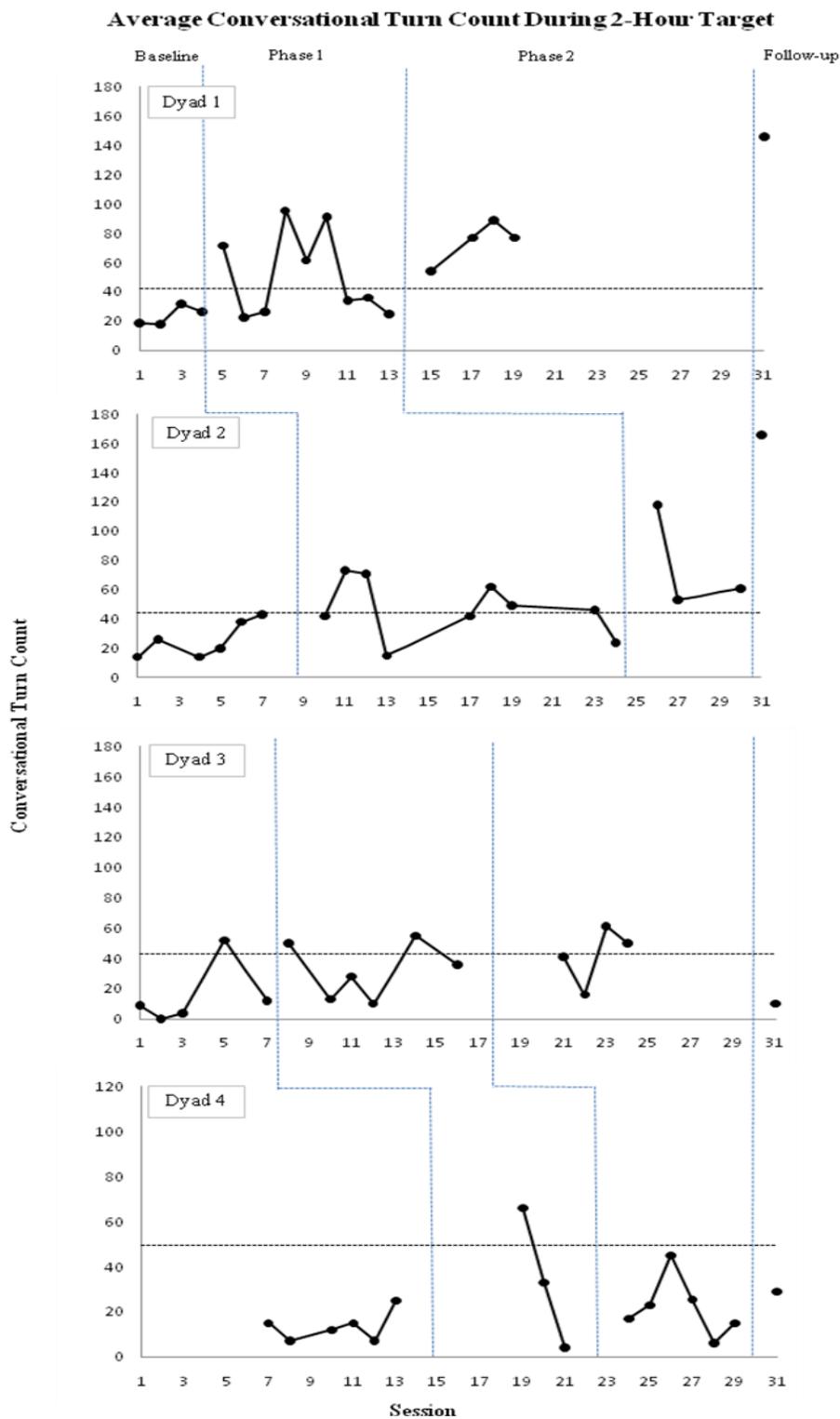


Figure 3. Multiple baseline across dyads representing Conversational Turns. Dashed horizontal line represents the 50th percentile based on LENA normative study.

Table 6

Mean Frequency and Range of Conversational Turns during 2-Hour Target Time

Dyad	Baseline	Intervention Phase 1	Intervention Phase 2	Follow- Up
1	24 (18-32)	52 (23-96)	74 (54-77)	146
2	26 (14-43)	47 (15-73)	77 (53-118)	166
3	15 (0-52)	32 (10-55)	42 (16-61)	10
4	14 (7-25)	34 (4-66)	21 (6-45)	29
Combined	20	41	54	88

Research question 5: If increases occur in AWC, CV, and/or CT, does this increase maintain? Three out of four dyads demonstrated maintenance of the skills they acquired during intervention. Dyads 1, 2, and 4 increased the amount of AWC, CV, and CT compared to the averaged scores from Phase 2. Dyad 3 did not show maintenance of skills acquired. Dyad 3 was in the process of moving at the time of follow up and may not have executed the intervention with fidelity. See Figures 1-3 for graphical depiction of follow-up data and Tables 1-3 for numerical values.

Activities survey. The activities survey was completed pre- and post-intervention with parents to determine if participation in this intervention would increase the relative importance they placed on language promotion activities as compared to other common activities parents do with their children. The first step of the activities survey was to rate the importance of the activities on a 5-point Likert scale with 1 being unimportant and 5 being very important. All parents rated all of the activities from 3 to 5 with 5 being the

most frequent. Next, parents were asked to rank order the activities based on importance with 1 being the most important activity they do with their child. Table 7 contains each parent's ranking of each activity pre- and post-intervention. The shaded boxes represent the activities that this intervention targeted. There was no systematic increase in the rankings of targeted activities.

Table 7

Parent Rankings of the Relative Importance of Activities Pre- and Post-Intervention

	Dyad 1		Dyad 2		Dyad 3		Dyad 4	
	<i>Pre</i>	<i>Post</i>	<i>Pre</i>	<i>Post</i>	<i>Pre</i>	<i>Post</i>	<i>Pre</i>	<i>Post</i>
Teaching your child numbers	11	1	4	6	8	10	7	10
Eating Healthy meals with your child	2	11	11	7	9	11	6	2
Having conversations with your child	9	10	3	1	5	1	2	9
Teaching your child to play nice with others	7	2	9	8	4	2	3	1
Coloring with your child	10	9	8	9	10	9	1	3
Asking your child questions	5	7	2	2	3	3	9	5
Reading with your child	1	4	1	3	6	4	4	4
Teaching your child manners	6	6	10	10	2	5	5	8
Telling your child what things are called	8	3	5	4	7	8	8	7
Playing with your child	3	8	7	11	11	7	11	6
Praising your child	4	5	6	5	1	6	10	11

Parent Satisfaction Data. Parents were asked to complete a parent satisfaction questionnaire following the completion of the intervention. All of the parents completed

the questionnaire. Table 8 lists the items on the parent satisfaction questionnaire and the number of parent endorsements for each rating. Parent participants rated the intervention favorably. Parents endorsed all positive statements about the intervention as “strongly agree” or “agree” except for one “neutral” response on the question pertaining to improvements in child behavior due to the intervention. Similarly, when rating the usefulness of various components of the intervention all endorsements were “very useful” or “useful” with 2 exceptions of “neutral” ratings. Finally when rating the home visitor on items such as “Helped me learn new ways to promote my child’s language development” and “I was comfortable having the home visitor in my home” all endorsements were positive.

Of the outcomes parents were asked to rate, “This project helped me have better interactions with my child” and “This project helped me increase my interactions with my child” were rated the highest. The strategies that were rated the highest in terms of usefulness included, “Seeing how much my child and I were talking on the graphs,” “Looking at the graphs showing my progress at increasing the amount of talk,” “Talking about ways to increase the amount I talked to my child with the home visitor,” “Seeing the home visitor use the new skills while playing with my child,” “Using the new skills outside of our sessions during the rest of the week,” and “The project manual or other forms.”

Comments provided by parents when asked what they liked about the project included, “I like the strategies the most,” “I liked the positive interaction I was able to complete with my son,” “Learning more ways to interact with the child,” and

“Everything.” When asked what they did not like one parent indicated the videos and two indicated that they did not like the beginning of the project when baseline was being collected and they had to keep the LENA on for 10-12 hours. Parent comments about what was most useful included, “The manual, it gave very descriptive and specific details on how I could help increase his speech,” “I thought the videos helped me the most because I seen what I needed to do,” “Seeing the graphs,” and “Learning to listen to them first.” Two parents did not respond to the prompt about what was least useful. The other two provided the following comments: “When I started working I found the 2-hour target to be very difficult” and “The time it takes, I think the strategies should be given sooner than 3 weeks.”

Table 8

Parent Satisfaction Survey

<u>Please circle the answer that best describes your feelings about each statement</u>					
	<i>Strongly Agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
1. This project has helped me be a better teacher for my child.	2	2			
2. This project helped me have <u>better</u> interactions with my child.	4				
3. This project helped me increase my interactions with my child.	4				
4. This project helped me feel better as a parent.	1	3			

5. My child seems to enjoy playing together more now than before the project.		4		
6. My child's behavior has gotten better since beginning the project.	1	2	1	
7. My child's language and communication has gotten better.	3	1		
8. I have learned new ways to teach my child to talk and to help my child's language grow.	3	1		
9. I enjoy the time I spend with my child more now than before the project.	3	1		
10. I have more ideas for activities I can do with my child now than before the project.	1	3		
11. I would tell other parents about this project.	2	2		
12. I have liked being in the project.	3	1		
<u>Please circle the answer that best describes how helpful these were to you.</u>				
	<i>Very useful</i>	<i>Somewhat useful</i>	<i>Neutral</i>	<i>Not very useful</i>
				<i>Not at all useful</i>
1. Seeing how much my child and I were talking on the graphs.	3	1		
2. Setting goals to increase the amount I talked to my child.	2	2		

3. Looking at the graphs showing my progress at increasing the amount of talk.	3	1	
4. Choosing the 2-hour target time to focus on interacting with my child.		3	1
5. Talking about ways to increase the amount I talked to my child with the home visitor.	3	1	
6. Seeing the home visitor use the new skills while playing with my child.	3	1	
7. Using the new skills while the home visitor was in my home.	2	2	
8. Using the new skills outside of our sessions during the rest of the week.	3	1	
9. The video.	3		1
10. The project manual or other forms.	4		

Please rate the home visitor

	<i>Strongly</i>				
	<i>Agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
1. Was helpful to me.	3	1			
2. Gave clear explanations.	2	2			
3. Helped me learn new ways to increase the amount I talked with my child.	3	1			
4. Helped me learn new ways to promote my child's language development.	3	1			

5. I enjoyed having the home visitor in my home.	3	1		
6. I was comfortable with the home visitor in my home.	2	2		
7. I would have preferred a home visitor who was of the same ethnic or racial background as me.			2	2

Chapter 5

Discussion

The purpose of this study was to evaluate the effectiveness of an intervention to enhance the quantity and quality of parent-child language interaction among families experiencing multiple social and environmental risk factors. Results indicate that the intervention package was effective at increasing the amount parents talked to their children as well as the amount the children vocalized and the number of dyadic verbal exchanges the parent and child shared. The first level of intervention, which included education about the importance of talking to young children in addition to graphical feedback, goal setting, and progress monitoring of adult word count, was effective at increasing the amount parents talked. The impact of education and graphical feedback on the amount the child vocalized and the number of dyadic conversational turns the parent and child shared was modest but increases were realized. Levels of all dependent variables were greatest during the second intervention phase, which involved teaching parents specific strategies for promoting communication in addition to graphical feedback.

Adult word count (AWC). The primary research questions focused on effects of the intervention on levels of parent-provided language input measured by AWC per hour. AWC was the primary variable of interest due to research suggesting that the quantity of language input children receive varies greatly among families, correlates highly with the socio-economic status of their parents, and is predictive of both contemporary language acquisition and later developmental outcomes (Hart & Risley, 1995; Hoff, 2003;

Huttenlocher et al., 1991). Multiple baseline data illustrating average AWC per hour during the 2-hour target time show an increase in child-directed adult talk when parents were broadly encouraged to increase their communication rates to children and given graphical feedback of their success in doing this. The strong response to the initial experimental condition tested here supports the hypothesis that education in conjunction with graphical feedback is an effective method to increase parent-provided language input, albeit with an effect that varies somewhat within and across parent-child dyads.

More intensive intervention, which included parent training on specific strategies for promoting children's language development, resulted in an increase in AWC over initial treatment levels for half of the dyads. The less robust response to direct parent training may be due to several factors. First, the initial experimental condition had a strong effect, with all dyads AWC average being near or above the 50th percentile compared to LENA norms. There was less room for improvement from the initial intervention phase to the more intensive phase than there was from baseline to the initial phase. Second, the strategies that were taught during direct parent training of language promotion strategies were meant to increase not only adult speech but also the number of dyadic parent-child conversations. Parents were encouraged to prompt their child to talk more through strategies such as asking more open-ended questions and praising vocalization attempts. Application of these strategies could actually reduce the number of adult words as the parent is encouraging the child to talk more. This conclusion is supported by Child Vocalization (CV) and Conversational Turn (CT) data, which were highest during Phase 2 of intervention for 3 out of 4 dyads.

The intervention employed in this study increased the number of adult words the target child heard from an average of 404 words per hour to 1,323 words per hour. This represents an increase from less than the 10th percentile to roughly the 70th percentile based on LENA norms. It is important to keep in mind that the families in the current study were not able to maintain that level of language input throughout the day and issues of generalizability need to be addressed in future research; however, this study provides evidence that parents providing low levels of language input can significantly increase their language input with a relatively brief intervention.

Child vocalizations. Although the primary goal of this intervention was to increase the amount that parents were talking to their children, it was hypothesized that this increase in language input would encourage children to vocalize more frequently themselves. A moderate, step-wise increase in CV did occur for 3 out of 4 dyads.

The amount of CV appeared to vary based on the activities parents choose. The most common activity that parents choose to do to increase the amount they were talking to their children was storybook reading. Storybook reading is a powerful way to increase the amount parents are talking; however, if parents are not implementing strategies that encourage the child to vocalize, such as asking the child questions about the story or labeling pictures, then storybook reading will decrease the amount the child is vocalizing. For example, the mother in Dyad 1 had a large increase in the amount she was talking during the initial intervention but when child vocalization data are examined an initial increase was followed by a decreasing trend. The amount this child was talking at the end of the initial experimental condition was actually lower than pre-intervention levels.

Listening to the audio recordings revealed that the reason for this child's decline in vocalizations was due to his mother encouraging him to be quiet and listen to the story. She did not want him interrupting during the story and if he did she would stop reading. He quickly learned to be quiet during storybook time which was a frequent activity during the 2-hour target time in the initial experimental condition. Once the parent was taught specific strategies for promoting their child's communication, the amount the child talked returned to above the 50th percentile and remained there for the rest of the study.

The child in Dyad 2 showed the most variability in the amount he talked, reflecting in part what seemed to the experimenter as a certain degree of chaos in this family's day-to-day life. This dyad had the most difficulty keeping appointments and completing 2-hour target times, as evidenced by the numerous missing data points on their graph. Fidelity of implementation likely contributed to the variability in the data for this dyad. The amount the target child in Dyad 3 vocalized was not affected much by the initial experimental condition. Conversely, this child's vocalizations increased significantly once her parent was taught strategies for encouraging vocalizations. A scenario similar to Dyad 1 was true for Dyad 4 as they did a lot of reading in Phase 1; however, Phase 2 did not result in an increase in the amount this child vocalized.

It is interesting to note that examination of initial levels of child communication to the final levels showed a substantial increase in the amount the target children were talking for Dyads 1, 2, and 3, with all data for exceeding the baseline median. Because this study was designed to determine if teaching communications strategies added value to information and graphical feedback alone it impossible to know the individual effect of

the phases. However, this information does provide further evidence that this intervention package taken as a whole does have a significant effect on the amount of child communication. Future research may examine the effect of parent training plus graphical feedback independently to determine its individual impact.

Conversational turns. The number of dyadic parent-child conversations increased with each phase of intervention; however, results were variable across and within dyads. The number of dyadic verbal exchanges was greatest during the second phase of intervention when specific strategies for promoting dyadic conversation were taught. This outcome supports the conclusion that teaching parents specific strategies for promoting communication has a greater impact on the *quality* of the language environment than education and graphical feedback alone. Recent research concluded that the number of dyadic exchanges between a parent and child is one of the greatest predictors of child language development, suggesting that this may be a variable of great impact and therefore great interest to interventionist (Zimmerman et al, 2009).

Parent and child factors. For the interventionist, family engagement was the greatest barrier to working with families experiencing multiple social and environmental risk factors. Informally, engagement was measured by the number of kept appointments, follow through with 2-hour target time, and level of interest and attention during visits with the interventionists. You might want to say that challenging life circumstances precluded or superseded engagement in activities.] The level of parent engagement in the current study varied and this variation can be seen in the outcome data. Dyad 1 was the most engaged family and had the most impressive outcomes. Interestingly, at the first

meeting this parent described her goal for the intervention as reducing the amount her son talks because she found it annoying and disruptive. This mother ranked language-promoting strategies such as telling your child what things are called and having conversations with your child as 8 and 9 out of 11 activities. This mother did not see talking to her son as especially important at the beginning of intervention. However, after a few meetings this mother became very engaged in the process. She never missed an appointment and she always gave the interventionist her full attention during meetings, sitting down at the table, asking questions, etc. This study was not designed to account for level of engagement and therefore conclusive comments cannot be made about its effect. However, engagement was observed to be an important variable especially for implementation integrity.

The effect of engagement in day-to-day data can be seen as well. Dyad 2 was initially very engaged in the study and its procedures. During the first week of intervention this family was very motivated and engaged and you can see in multiple baseline graphs of AWC (see figure 1) that the level of AWC increased steadily for the first three data points. Then the mother in this dyad, who had been unemployed for over a year, got a job. This resulted in her being busier and having more divided attention during meetings with the interventionist. She also missed several appointments. It appears that this decrease in engagement affected intervention results, as noted by a decrease in AWC that coincided with the start of her new job.

Another key variable that appeared to affect outcomes was the extent to which families had a regular schedule. Families that had a somewhat consistent schedule had an

easier time choosing a 2-hour target and sticking with the same time each day. This seemed to help families get in a rhythm. Families who had a consistent target time were less likely to miss sessions and had more consistent results.

The barriers to engagement differ from family-to-family. Some families have a difficult time engaging because they are so stressed that they cannot focus on yet one more thing such as the home literacy environment, some parents have mental health issues that make it difficult for them, others may not fully “buy-in,” and others may have such chaotic lives that it is difficult to be consistent. Because each family has different needs, some individualization in the method of engagement was necessary. For example, in this study several parents preferred text message to phone calls. A text message reminder that their 2-hour target time was about to begin was helpful for some while others had a consistent target time in place and did not need this reminder. Another example is the amount of non-intervention-specific conversation that the interventionist had with the families. Several of the mothers in this study were socially isolated and enjoyed conversation with another adult. For some this conversation was just small talk, for others it was a time to process stressful events that were happening in their lives or get the interventionist’s input on general questions about their child or their other children. Although the topics of conversation differed, it was a conduit to engagement for all dyads.

Persistence and flexibility on the part of the interventionist was necessary to complete this study. The families in this study faced many challenges and had a variety of obligations, and many times would not be home for a scheduled appointment.

Multiple attempts were often necessary to get one data point. The interventionist operated with an understanding that families in this study were busy, stressed, and doing the best they could. This was the key to retention. If a family were not able to complete the 2-hour target as scheduled on a particular day, the interventionist would come back the next. Without this persistence and flexibility this study would not have been completed.

In addition to parent factors that affected outcomes, child factors also played a role. Each child was different and required varying levels of scaffolding from their parents. Some of the children were very motivated by attention from their mother and would stick with her and play for the 2-hour target time. Other mothers struggled to engage their child for even a fraction of this time, reporting the child just didn't want to play with her. Some children were very talkative while others were speaking only a few words. Anecdotally, it did appear to be more difficult for the mothers whose children were less talkative to increase their language input. This could be in part due to the lack of child initiation of verbal interaction.

Limitations. The primary objective of his study was to develop an intervention that effectively enhanced parent-child language interactions within participant's natural home environment. A copious amount of research has established the key variables that contribute to optimal language development. Researchers and early interventionist can identify the types of interactions and activities that promote child communication. What is still lacking is research on methods to successfully intervene with families within natural contexts to ensure that all children are exposed to the necessary inputs for optimal

language development. Especially sparse is research focused on interventions that are feasible and effective for parents who are struggling to manage the basic needs of their families. Therefore, the natural context of the home can be seen as both a strength and limitation of this study.

Conducting this study in the natural home environment of these families enhances the external validity of the findings. On the other hand, conducting research in natural environments means that extraneous variables are more difficult to control, decreasing the internal validity of the study. Methods to control extraneous variables included giving specific directions for what constituted the 2-hour target time (you are home with your child, your child is awake, and you do not have visitors). The families also completed a session questionnaire at the end of each session that asked questions such as the exact start and end of the target time, were there any visitors, what time did the child nap today, did you go anywhere today, was this a typical day, etc. This questionnaire allowed the investigator to determine if the parent had appropriately followed the guidelines for the 2-hour target. However, in the natural environment distractions are inevitable: the phone rings, the younger child needs changing, the TV is on, a neighbor stops over, etc. These real world distractions make the findings of this study even more significant. The study found an effect even through all of these potential distractions. At the same time results should be considered with caution, as extraneous variables could not be totally controlled in this study.

Missing data points are also a reality of working with families in natural contexts. The most resource-intensive part of this study was connecting with families. Three of the

four families did not have reliable telephone service and all of the families had a variety of other factors that at times interfered with their ability to implement this intervention. For example, one participant had an older son who was addicted to drugs and stealing from her, another mother was unemployed and lost her assistance so was often having to travel downtown to get emergency assistance. All of the families were experiencing extreme economic hardship and were concerned about basic needs.

Implications for policy. Based on their longitudinal study of children's language environments Hart and Risley (1995) concluded that any program seeking to equalize the language experience of children living in poverty to that of children of working-class parents would have to start at birth and run year around with a one-to-one staff-to-child ratio to simulate the individualized language experience provided by professional parents. An intervention of this magnitude is unlikely due to economic and political factors. It may also be unpalatable to families. However, the current study suggests that with enough support and guidance parents are able to provide their children with more enriched language environments. The parents in this study were able to increase the language input they provided their children during the 2-hour target time from a level below the 10th percentile to the around the 70th percentile compared to LENA norms. If a method for generalizing this increase to the entire day is realized, research would suggest that this substantial increase in language input would have a significant impact on the target child's language and literacy development.

Hart and Risley argued that supporting parents to improve the home literacy environments of young children is an alternative worth trying. Benefits to intervening

early with parents abound. First, successful early parenting interventions not only teach parents what to do now with their children, but help parents to recognize that what they do with, around, and for their child affects that child's outcomes. The empowerment parents receive from this may alter the way they parent that child for the rest of the child's life (Dishion et al., 2008). Also, parents who are active participants in their child's early education will be more likely to continue to be involved in that child's education throughout schooling (Miedel & Reynolds, 1999), which research has demonstrated is an important variable for academic success (Barnard, 2004; Christenson & Sheridan, 2001). In addition, successful intervention with a parent teaches that parent skills that they can implement with their other children resulting in an even greater return on investment.

The impact of early parenting on individual trajectories is vast. As a nation we are concerned with closing the achievement gap and helping all children succeed. This is not only a humanitarian goal but also an economic one. Children who are exposed to quality early childhood environments go on to be kindergarteners who are prepared to benefit from instruction which sets them on a trajectory for success in school and beyond. Conversely, children who do not have the necessary early inputs may not be ready for kindergarten, and unfortunately do catch up with their peers but fall further behind as they move through school (Juel, 1988). In the second scenario everyone loses, that child does not reach their full potential and as a nation we will spend a significant amount of money providing ineffective tertiary supports (Rolnick & Grunewald, 2003). To effectively close the achievement gap, we need a national commitment to ensuring that

all children have an enriched early experience and are provided the language environment necessary for optimal development. The results of this study suggest that intervening with parents could be one component of a comprehensive initiative to provide all children with an enriched early language environment.

Implications for future research. This study is the first in a line of research that will result in an effective intervention to enhance the quantity and quality of children's language environments not only during a 2-hour period but over an entire day, week, month, and year. More research is needed to determine effective methods for generalizing the effects realized in this study. One possibility is to intersperse shorter target times throughout the day. For example, asking parents to do 8, 15-minute target times throughout the day. This may promote more generalization of strategies across different times of day, settings, etc. Another possibility would be to focus more on teaching parents the strategies taught in the Promoting Communication Intervention in a Routines Based Intervention model so that we are not asking parents to do anything out of their normal routine but instead incorporate language promotion strategies into their everyday routines. The 2-hour target time was hard for parents in this study and resulted in missed data points when the parent indicated that they could not complete a target time (i.e. were not with their child, had visitors, etc.). The issue with using data from the entire day is the lack of control over extraneous variables. For example, if the parent is at the grocery store during the target time the AWC may be higher due to other adults talking near the child. In the current study we were able to control for this by requiring that the parents were home with their child during the target time. Future technological

advances that allow the LENA system to identify a target adult would alleviate this concern and enhance internal validity.

Another question for future research to address is the effectiveness of the *Promoting Communications Intervention* in conjunction with graphical feedback from LENA independent of the initial intervention phase. This level of intervention appeared to have the greatest impact on the variables of interest. Although its effect on parent-provided language input may not be substantial enough to warrant the extra time it takes to teach, model, and provide feedback on language promotion strategies, its effect on the number of dyadic conversations substantiates its benefits and warrants its use. A study should be done in which subjects move directly from baseline to an intervention phase, which includes graphical feedback in addition to teaching language promotion strategies.

A method for tailoring interventions for individual families also needs to be addressed in future research. An interesting study may apply the Response to Intervention model to parent education on promoting communication strategies. As was experienced in the current study, parents have varying needs on the level of intervention required for them to increase the amount of language input they provide their children. Some parents may need only general education about why language input is important, some may need education in conjunction with progress monitoring, and others may require direct instruction in the promoting communication strategies. A comprehensive, tiered intervention model for enhancing the quantity and quality of parent-child interactions would increase the efficiency of intervention while meeting the needs of individual families.

Finally, once an effective intervention for increasing parent-child interaction has been established, longitudinal research on child outcomes will need to be conducted to confirm or disconfirm Hart and Risley's conclusion that the amount of language input a child receives in early childhood has a long-term impact on their language development and academic success. This relationship is supported by a significant amount of correlational research but manipulation of the dependent variable followed by longitudinal research on child outcomes has yet to be completed. This research is needed to demonstrate a causal link between early parent-child language interaction and subsequent developmental outcomes.

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Appendix A

Family Information

Today's Date: ____/____/____

Parents Full Name:

Parent's Date of Birth (month/day/year): ____/____/____

Child's Full Name:

Child's Date of Birth (month/day/year): ____/____/____

QUESTIONS ABOUT YOUR CHILD

How would you describe your child?

Mark one or more:

____ Asian or Pacific Islander

____ Black or African-American

____ Hispanic/Latino

____ Native American

____ White or European-American

____ Other – Please

describe _____

Has your child had any major health or speech problems or been diagnosed with a disability?

____ Yes ____ No

If yes, please describe:

Have you had any concerns about your child's health or development?

____ Yes ____ No

If yes, please describe:

Is your child receiving any services besides Way to Grow (e.g., health department, WIC, Healthy Start, or Head Start)?

____ Yes ____ No

If yes, please describe:

If you have other children, what are their ages?

Child's Name	Date of Birth

Are they all living with you?

_____ Yes _____ No

If no, please describe:

QUESTIONS ABOUT YOU

Your Marital Status:

- _____ Single
- _____ Married
- _____ Living with Partner
- _____ Divorced
- _____ Widowed

How would you describe yourself?

Mark one or more:

- _____ Asian or Pacific Islander
- _____ Black or African-American
- _____ Hispanic/Latino
- _____ Native American
- _____ White or European-American
- _____ Other – Please

describe _____

What is the highest grade you have completed in school (circle one)?

6th 7th 8th 9th 10th 11th 12th Some Trade 2 Year 4 Year
 _____ College School Degree Degree

Diplomas, certificates, or other education:

Are you currently going to school?

_____ Yes _____ No

If yes, please describe:

If you have not yet graduated from high school or earned a GED, do you plan to do so in the future?

_____ Yes _____ No

Are you currently employed?

_____ Yes _____ No

If yes, how many hours per week are you working?

_____ less than 20 hour per week on average

_____ 20-30 hours per week on average

_____ more than 30 hours per week on average

If yes, what type of work do you do?

What is your own personal yearly income?

_____ \$0 to \$4,999	_____ \$20,000 to \$24,999
_____ \$5,000 to \$9,999	_____ \$25,000 to \$29,999
_____ \$10,000 to \$14,999	_____ \$30,000 to \$34,999
_____ \$15,000 to \$18,100	_____ \$35,000 to \$39,999
_____ \$18,200 to \$19,999	_____ \$40,000 or higher

What is your yearly total household income?

_____ \$0 to \$4,999	_____ \$20,000 to \$24,999
_____ \$5,000 to \$9,999	_____ \$25,000 to \$29,999
_____ \$10,000 to \$14,999	_____ \$30,000 to \$34,999
_____ \$15,000 to \$18,100	_____ \$35,000 to \$39,999
_____ \$18,200 to \$19,999	_____ \$40,000 or higher

Who else lives with you?

First Name	Relationship to Mother	Age

Are you receiving any kind of services or assistance (e.g., WIC, Temporary Assistance to Needy Families [TANF], or Food Stamps, parenting services other than WTG, education or employment assistance)?

_____ Yes _____ No

If yes, please describe:

How long have you been working with your Way to Grow Family Educator?

What do you think are the most important things you have learned from your family educator?

If we cannot get in contact with you, is there another person we can contact who can reach you, like your mother or a good friend?

Name and who this is:

Phone Number: (_____)_____

Thank You!

Appendix B

Activities Survey

Parent Name: _____

Child's Name: _____

Date: _____

How important do you think it is to do the following activities with your child?

	Unimportant	Of little Importance	Moderately Important	Important	Very Important
Teaching your child numbers	1	2	3	4	5
Eating healthy meals with your child	1	2	3	4	5
Having conversations with your child	1	2	3	4	5
Teaching your child to play nice with others	1	2	3	4	5
Coloring with your child	1	2	3	4	5
Asking your child questions	1	2	3	4	5
Reading with your child	1	2	3	4	5
Teaching your child manners	1	2	3	4	5
Telling your child what things are called	1	2	3	4	5
Playing with your child	1	2	3	4	5
Praising your child	1	2	3	4	5

Now, please rank order these activities by their relative importance. The activity you rank as 1 is the most important activity for you to do with your child. The activity you rank as 11 is the least important for you to do with your child.

Teaching your child numbers _____

Eating healthy meals with your child _____

Having conversations with your child _____

Teaching your child to play nice with others _____

Coloring with your child _____

Asking your child questions _____

Reading with your child _____

Teaching your child manners _____

Telling your child what things are called _____

Playing with your child _____

Praising your child _____

Appendix C

Parent Feedback

Thank you for participating in this project! I would like to hear your thoughts about it! Information I receive from parents like you will be used to improve the program and make changes that will help other families in the future. Please be as honest as possible. Your name is not on this form. Your answers will be kept private.

Please circle the answer that best describes your feelings about each statement.

1. This project has helped me be a better teacher for my child.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
2. This project helped me have <u>better</u> interactions with my child.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
3. This project helped me increase my interactions with my child.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
4. This project helped me feel better as a parent.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
5. My child seems to enjoy playing together more now than before the project.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
6. My child's behavior has gotten better since beginning the project.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
7. My child's language and communication has gotten better.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
8. I have learned new ways to teach my child to talk and to help my child's language grow.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
9. I enjoy the time I spend with my child more now than before the project.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
10. I have more ideas for activities I can do with my child now than before the project.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
11. I would tell other parents about this project.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

12. I have liked being in the project.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
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Please circle the answer that best describes how helpful these were to you.

1. Seeing how much my child and I were talking on the graphs.	Very useful	Somewh at useful	Neutral	Not very useful	Not at all useful
2. Setting goals to increase the amount I talked to my child.	Very useful	Somewh at useful	Neutral	Not very useful	Not at all useful
3. Looking at the graphs showing my progress at increasing the amount of talk.	Very useful	Somewh at useful	Neutral	Not very useful	Not at all useful
4. Choosing the 2-hour target time to focus on interacting with my child.	Very useful	Somewh at useful	Neutral	Not very useful	Not at all useful
5. Talking about ways to increase the amount I talked to my child with the home visitor.	Very useful	Somewh at useful	Neutral	Not very useful	Not at all useful
6. Seeing the home visitor use the new skills while playing with my child.	Very useful	Somewh at useful	Neutral	Not very useful	Not at all useful
7. Using the new skills while the home visitor was in my home.	Very useful	Somewh at useful	Neutral	Not very useful	Not at all useful
8. Using the new skills outside of our sessions during the rest of the week.	Very useful	Somewh at useful	Neutral	Not very useful	Not at all useful
9. The video.	Very useful	Somewh at useful	Neutral	Not very useful	Not at all useful
10. The project manual or other forms.	Very useful	Somewh at useful	Neutral	Not very useful	Not at all useful

What part of this project was most helpful to you?

Least helpful?

Please rate the home visitor.

1. Was helpful to me.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
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2. Gave clear explanations.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
3. Helped me learn new ways to increase the amount I talked with my child.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
4. Helped me learn new ways to promote my child's language development.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
5. I enjoyed having the home visitor in my home.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
6. I was comfortable with the home visitor in my home.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
7. I would have preferred a home visitor who was of the same ethnic or racial background as me.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

What did your home visitor do well?

What is one thing your home visitor could have done better?

General Comments

Things I **liked** about the project:

Things I **did not** like about the project:

Things I would **change** about the project:

Other comments:

Adapted from *Talk to Me Parent Feedback form*. Bigelow, K. M. (2006). *Communication promotion and planned activities with families experiencing multiple risks*. Unpublished Doctor of Philosophy, University of Kansas.

Appendix D

Session Outlines

Baseline

Baseline: Session 1

1. Provide parent with “Recording Session Instruction Booklet.”
2. Explain Baseline:
 - a. “For the next few weeks we will have your child wear the LENA three days per week. We want to pick three days of the week that will work well for you for the next six to eight weeks. During this phase of the program we want you to go about your normal day. Your child should keep the LENA on all day. If they do take a nap you can leave it on or if you’d rather you can take it off but leave the recorder on and leave the vest close to your child. When your child goes to bed for the night you can turn off the LENA by holding the power button down for 3 sec. The LENA should say “recording” and the timer should be advancing at all times throughout the day. If you notice that it says something other than “recording” please hold down the rec button until it says recording again and the timer is advancing.”
3. Demonstrate how to turn LENA on and off. Be sure they understand that the screen should always say “recording” and the timer should be on and advancing.
4. Turn on LENA and put on child.
5. Give parent the “Session Questions” document. Ask them to fill it out as the day goes as it is hard to recall exact times after the fact.

Baseline: Session 2 – Final Baseline

1. Pick up LENA from previous day and session question form.
2. Ask how it went. Any questions or concerns?
3. Turn on LENA and put on child.
4. Give parent a “Session Questions” document.
5. Provide gift card.

Intervention Phase 1

Phase 1: Session 1

1. Complete the activities survey and the McArthur.
2. Explain Phase 1:

- a. “We’ve collected a lot of information over the past few weeks and I finally get to share that information with you. First I’m going to explain to you a little bit about how the LENA system works.”
 - b. “When I download the information from the recorder onto the computer the LENA program automatically codes the audio data into the number of vocalizations the child makes, the number of words the child heard from an adult, and the number of conversational turns between an adult and the child. The LENA then generates these graphs. These are the graphs from last time CHILD wore the LENA. It tells us the number of words CHILD said each hour as well as the number of words s/he heard and the number of conversations s/he had.”
3. Explain the norms
 - a. “LENA did a big study where they had 329 people use LENAs once a month for 6 months.”
 - b. “From all this data they were able to determine the number of words that parents say to their children on average, the number of words kids say on average, and the number of conversations that occur.”
4. Explain their scores compared to the norms
 - a. “So with the data we have collected we can determine where you and CHILD fall compared to other parents and children his age.”
 - b. You are at about the __ percentile, which means that __% of parents talk less then you and __% talk more then you.”
5. Review the “Why talking is important” handout
 - a. “The number of words that a child hears throughout the day is related to their vocabulary size. So the more words they hear, the more words they know.”
 - b. “We also know that the size of kids’ vocabulary at age 3 is related to their reading ability in 3rd grade. Kids with smaller vocabularies have a harder time learning to read than those with greater vocabularies.”
 - c. “Reading is the basis for all learning, so kids that are good readers tend to do well in school. Kids that are poor readers tend to struggle.”
6. Discuss the 2-hour time period and data from that 2 hours.
 - a. “For the next phase in the project we need to identify a 2-hour time period where you and CHILD will be together, awake, available to one another, and typically home just the two of you.”
 - b. “From looking over the graphs and your session logs I thought 2-HOUR TIME BLOCK might be a good time. CHILD is usually awake at this time and it looks like you guys are usually home together at this time. Do you agree? You will have the option to choose a different 2-hour time

- period on days that you guys have something abnormal planned during that time but we want to keep it consistent as possible.”
- c. “For the next week or two during this 2-hour period I want you to really focus on talking and interacting with CHILD.”
7. Set goal for increasing adult word count during those 2 hours.
 - a. “Our next step is to set a goal for how much you are going to increase the number of words you say to CHILD during these 2 hours. Ideally we want the Adult Word Count to be at or above the 50th percentile. Do you think it is reasonable to set the goal at ___ which is the 50th percentile?”

Phase 1: Session 2

1. No new information to review.
2. Pick up recorder and “Session Question” document.
3. Drop off new recorder and vest.
4. Ask how it went? “Do you think you guys talked more during target time?”
5. “Remember, we are trying to get above the 50th percentile during that 2-hour period.”
6. “Tomorrow when I come we will look at the graph with yesterday’s information on it! Can’t wait to see how you did! Have a great day and remember to talk as much as you can with CHILD.”
7. Provide gift card.

Phase 1: Session 3 – Final Phase 1 Session

1. Review the graphs with P1.1 data point graphed.
2. Did they meet their goal?
 - a. Yes
 - i. Praise them for meeting their goal.
 - ii. Ask what they did to increase the amount of talking
 - iii. Show them how when they talked more their child also talked more which is great for their language development
 - b. No
 - i. Why do you think the amount you talked to CHILD didn’t increase?
 - ii. Let’s try again today! Remember we are trying to get at least to the 50th percentile!

Intervention Phase 2

Phase 2: Session 1

1. Explain Phase 2.
 - a. “We will now be using a program that will teach you ways to promote communication with your child and strategies for enhancing their language development. Each time I come you will learn a new strategy that you can use. From now on our sessions will consist of watching a video segment that provides us with information about a strategy for improving communication; we will discuss ways you are already using the strategy and new ways you can include that strategy into your routines and into your 2-hour target time. We will also practice the strategies with your child.”
2. Review graphs.
 - a. Discuss what areas could be improved (i.e. AWC, CT, CV)
 - b. Set a goal for Phase 2.
3. Teach strategy:
 - a. Watch the video segment for that strategy which provides an explanation of what the strategy is, why it is important, and ways to implement it. Follow along in manual.
 - i. Watch the following segments:
 1. Overview and Purpose
 2. Arranging the Environment
 3. Following a Child’s Lead
 4. Commenting and Labeling
 - b. Interventionist talks with the parent about specific ways they can use the strategy during the 2-hour target time.
 - c. If the child is available the interventionist models the strategy for the parent.
4. Provide parent with self-check sheet and instructions for completion.

Phase 2: Session 2

1. Review graphs.
 - a. Discuss progress towards goal.
2. Talk about how previously taught strategy went. How useful/difficult did parent find that strategy. How did they incorporate it into the 2-hour target.
3. Teach strategy:
 - a. Watch the video segment for that strategy which provides an explanation of what the strategy is, why it is important, and ways to implement it. Follow along in manual.

- i. Watch the following segments:
 - 1. Imitating and Expanding
- b. Interventionist talks with the parent about specific ways they can use the strategy during the 2-hour target time.
- c. If the child is available the interventionist models the strategy for the parent.

Phase 2: Session 3

- 1. Review graphs.
 - a. Discuss progress towards goal.
- 2. Talk about how previously taught strategy went. How useful/difficult did parent find that strategy. How did they incorporate it into the 2-hour target?
- 3. Teach strategy:
 - a. Watch the video segment for that strategy which provides an explanation of what the strategy is, why it is important, and ways to implement it. Follow along in manual.
 - i. Watch the following segments:
 - 1. Open-Ended Questions
 - b. Interventionist talks with the parent about specific ways they can use the strategy during the 2-hour target time.
 - c. If the child is available the interventionist models the strategy for the parent.

Phase 2: Session 4

- 1. Review graphs.
 - a. Discuss progress towards goal.
- 2. Talk about how previously taught strategy went. How useful/difficult did parent find that strategy. How did they incorporate it into the 2-hour target?
- 3. Teach strategy:
 - a. Watch the video segment for that strategy which provides an explanation of what the strategy is, why it is important, and ways to implement it. Follow along in manual.
 - i. Watch the following segments:
 - 1. Praise and Positive Attention
 - b. Interventionist talks with the parent about specific ways they can use the strategy during the 2-hour target time.
 - c. If the child is available the interventionist models the strategy for the parent.

Phase 2: Session 5

1. Review graphs.
 - a. Discuss progress towards goal.
2. Talk about how previously taught strategy went. How useful/difficult did parent find that strategy. How did they incorporate it into the 2-hour target?
3. Teach strategy:
 - a. Watch the video segment for that strategy which provides an explanation of what the strategy is, why it is important, and ways to implement it. Follow along in manual.
 - i. Watch the following segments:
 1. Providing Choices
 - b. Interventionist talks with the parent about specific ways they can use the strategy during the 2-hour target time.
 - c. If the child is available the interventionist models the strategy for the parent.

Phase 2: Session 6

1. Review graphs.
 - a. Discuss progress towards goal.
2. Talk about how previously taught strategy went. How useful/difficult did parent find that strategy. How did they incorporate it into the 2-hour target?
3. Teach strategy:
 - a. Watch the video segment for that strategy which provides an explanation of what the strategy is, why it is important, and ways to implement it. Follow along in manual.
 - i. Watch the following segments:
 1. Time Delay/Fill in the Blank
 - b. Interventionist talks with the parent about specific ways they can use the strategy during the 2-hour target time.
 - c. If the child is available the interventionist models the strategy for the parent.

Appendix E

Parent Handout

Why is talking to your child important?

- Promoting communication and language development in infants and toddlers is important for many reasons. Research has shown that talking to your child and encouraging them to babble and talk...
 1. Promotes appropriate social interaction
 2. Predicts greater vocabulary size at age 3 and beyond
 3. Predicts reading and language skills by 3rd grade
 4. Predicts Kindergarten readiness
 5. Helps to prevent problem behaviors
- So, talking to children is very important. It helps young children to become better communicators, to become better prepared for school, and to develop the communication skills to build friendships.

Appendix F

Fidelity Checklist

Fidelity Checklist for Phase 1

Check if Completed	Core Features of Phase 1
	Interventionist explained how LENA works (if first session in phase 1)?
	Interventionist explained LENA norms (if first session in phase 1)?
	Interventionist explained the participant's scores compared to the LENA norms (if first session in Phase 1)?
	Interventionist discussed why talking is important (if first session in Phase 1)?
	Interventionist reviewed graphs with parent?
	Interventionist discussed goal with parent?

Fidelity Checklist for Phase 2

Check if Completed	Core Features of Phase 2
	Interventionist explained what we will be doing in phase 2 (if first session in phase 2)?
	Interventionist played video segment for parent?
	Interventionist talked with parent about specific ways they can use the strategy during the 2-hour target time?
	Interventionist reviewed graphs with parent?
	Interventionist discussed at least 1 previously taught strategy (NA if first session)?

Appendix G

Non-Technical Summary

Research has concluded that the amount parents talk and interact with their young children affects children's language and early literacy development. Children learn through interactions with a parent or caregiver who is responsive to their interests and needs. Research has also concluded that the amount parents talk and interact with their young children varies widely among families. Generally speaking, research has found that families living in poverty tend to talk and interact with their children less than middle-or upper-class families.

Purpose

The purpose of this research was to find a way to help parents living in poverty increase the amount that they talked and interacted with their child. Participants in the study were mothers who were home with their child the majority of the time, who were living below the federal poverty line, and who were initially talking and interacting with their children less than would be desirable.

Intervention

The intervention consisted of two parts. First, mothers were provided with information on the importance of talking and interacting with young children. They also received information about how much they were currently talking to their child. This information was gathered using the Language ENvironment Analysis (LENA), a technology that allows child language environments to be recorded and provides information about the number of adult words, child vocalizations and conversational turns an adult and child share. The interventionist worked with the mothers to set goals for increasing the amount they talked to their child during a 2-hour block of time that the mother set aside each day. The interventionist shared the information about how much the mother and child were talking 3 times per week for a few weeks. Next, the interventionist taught the mother specific strategies using the Promoting Communication Intervention. Strategies included activities like labeling things in the environment and asking questions.

Results

The intervention was successful! Mothers in this study significantly increased the number of words they spoke to or around their child. They were also able to increase the amount their child vocalized and the number of back and forth conversations they shared. The first part of the intervention, which included general education about the importance of talking to children and feedback on how much they were currently talking, worked well for increasing the amount the mother spoke but the second part, when the mothers were taught strategies for encouraging their child to vocalize and interact, had a larger impact on the amount the child vocalized and the number of conversations that were shared.