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PARENTAL RESPONSIVITY AND LANGUAGE OUTCOMES DURING A LANGUAGE  
INTERVENTION FOR CHILDREN WITH DEVELOPMENTAL DELAYS

by

NONYÉ A.O. NWOSU

Under the Direction of Mary Ann Ronski, PhD

ABSTRACT

The purpose of this study was to assess the relationship between maternal responsivity and language outcomes after a 24-session language intervention in a sample of 62 toddlers with significant developmental delays and fewer than 10 spoken words. The data for this secondary analysis were taken from a longitudinal study that evaluated language outcomes after augmented or spoken language intervention (Ronski et al., 2010). Instances of maternal responsivity increased from pre-intervention to post-intervention and directive behaviors decreased slightly across all intervention groups. The results suggest a relationship between maternal responsivity and expressive language outcomes in children with developmental delay who use augmentative and alternative communication. These findings support the role of parents as social partners in language interventions.

INDEX WORDS: Developmental delay, Developmental disability, Maternal responsivity, Language intervention, Augmentative and alternative communication, Parental responsivity

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NONYÉ A.O. NWOSU

A Thesis Submitted in Partial Fulfillment of the Requirement for the Degree of  
Master of Arts  
In the College of Arts and Sciences  
Georgia State University  
2016

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2016

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INTERVENTION FOR CHILDREN WITH DEVELOPMENTAL DELAY

by

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August 201

## **DEDICATION**

I would like to dedicate this project to my family and friends who have been a constant source of inspiration and support, namely Ifeyinwa and Azikiwe Nwosu, Chioma Nwosu, Ebele Nduka, Okezika Kanu, and my dear sister, Nnedinma Nwosu.

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## TABLE OF CONTENTS

<b>ACKNOWLEDGEMENTS .....</b>	<b>v</b>
<b>1 INTRODUCTION.....</b>	<b>1</b>
<b>1.1 Maternal Responsivity.....</b>	<b>2</b>
<i>1.1.1 What is Maternal Responsivity? .....</i>	<i>3</i>
<i>1.1.2 Characteristics of Maternal Responsivity. ....</i>	<i>4</i>
<i>1.1.3 Contributors to Maternal Responsivity. ....</i>	<i>5</i>
<i>1.1.4 Maternal Responsivity and its Relationship to Language.....</i>	<i>6</i>
<b>1.2 Maternal Responsivity and Developmental Delay .....</b>	<b>8</b>
<i>1.2.1 Measuring Maternal Behavior .....</i>	<i>14</i>
<i>1.2.2 Maternal Behavior Rating Scale. ....</i>	<i>14</i>
<i>1.2.3 Responsive Augmentative and Alternative Communication (AAC) Style scale. ...</i>	<i>15</i>
<i>1.2.4 Event-based Coding Schemes.....</i>	<i>16</i>
<b>1.3 Language Intervention .....</b>	<b>17</b>
<i>1.3.1 AAC and Language Interventions.....</i>	<i>17</i>
<b>1.4 Research Questions.....</b>	<b>20</b>
<b>2 METHOD .....</b>	<b>22</b>
<b>2.1 Study Design .....</b>	<b>22</b>
<b>2.2 Participants.....</b>	<b>22</b>
<i>2.2.1 Toddlers. ....</i>	<i>23</i>
<i>2.2.2 Parents.....</i>	<i>23</i>
<b>2.3 Procedures .....</b>	<b>24</b>
<i>2.3.1 Assessments. ....</i>	<i>24</i>
<i>2.3.2 Interventions.....</i>	<i>25</i>
<b>2.4 Measures .....</b>	<b>25</b>
<i>2.4.1 Language transcripts. ....</i>	<i>26</i>
<i>2.4.2 Coding parental behavior. ....</i>	<i>26</i>
<i>2.4.3 Coding.....</i>	<i>28</i>
<b>3 RESULTS .....</b>	<b>30</b>
<b>3.1 Parental Responsivity and Component Behavior Management.....</b>	<b>30</b>
<b>3.2 Research Question 1: Parental responsivity over the intervention.....</b>	<b>33</b>
<i>3.2.1 Target Vocabulary.....</i>	<i>35</i>
<b>3.3 Research Question 2: Parental Responsivity and Target Vocabulary Outcomes.....</b>	<b>36</b>
<b>4 DISCUSSION .....</b>	<b>38</b>

<b>4.1</b>	<b>Research Question 1: Change in Parental Responsivity over Intervention .....</b>	<b>38</b>
<b>4.2</b>	<b>Research Question 2: Parental Responsivity and Target Vocabulary Outcomes.</b>	<b>39</b>
<b>4.3</b>	<b>Limitations.....</b>	<b>40</b>
<b>4.4</b>	<b>Future Research Directions .....</b>	<b>40</b>
<b>4.5</b>	<b>General Discussion.....</b>	<b>41</b>
<b>References</b>	<b>.....</b>	<b>44</b>
<b>Appendix A</b>	<b>.....</b>	<b>55</b>
<b>Appendix B</b>	<b>.....</b>	<b>56</b>
<b>Appendix C</b>	<b>.....</b>	<b>57</b>

**LIST OF TABLES**

<i>Table 2.1 Parent Demographic Information .....</i>	<i>24</i>
<i>Table 2.2 Reliability of the Challenging Behavior Codes .....</i>	<i>29</i>
<i>Table 3.1 Analysis of Variance for Parental Behaviors .....</i>	<i>34</i>
<i>Table 3.2 Parental Behavior Frequencies .....</i>	<i>35</i>
<i>Table 3.3 Bivariate Correlations Among Functional Vocabulary &amp; Parental Behaviors .....</i>	<i>36</i>
<i>Table 3.4 Bivariate Correlations Among Functional Vocabulary Across Interventions .....</i>	<i>37</i>

**LIST OF FIGURES**

<i>Figure 3.1 Scatterplot of Parental Responsivity.....</i>	<i>31</i>
<i>Figure 3.2 Scatterplot of Component Behavior Management.....</i>	<i>32</i>
<i>Figure 3.3 Graph of Parental Responsivity Changes.....</i>	<i>33</i>

## 1 INTRODUCTION

Families of children with developmental delays and little functional speech may experience challenges communicating with their child and meeting their needs (Broberg, Ferm, & Thunberg, 2012; Landry, Smith, Swank, & Guttentag, 2008; Smith, Ronski, Sevcik, Adamson, & Bakeman, 2011). Thus, communication difficulties have the potential to bi-directionally affect these relationships and the family structure (Landry et al., 2008; Smith et al., 2011). Parental responsivity is one aspect of parenting style that is critical to early child development, especially communication (Ainsworth & Wittig, 1969; Brady, Warren, & Sterling, 2009; Warren & Brady, 2007). It refers to parents' emotional and physical response to their child's needs. More specifically, Bornstein and Tamis-LeMonda (1997) noted that parents' prompt, contingent, and appropriate behaviors should be direct, exclusive, and immediate to their child's behavior. According to Sameroff and Chandler's (1975) transactional model of development, early socio-emotional, communication, and cognitive development is dependent upon the dyadic interactions between children and their caregivers. These aspects of development may be facilitated by the emergence of joint attention at around nine months in typically developing children, though it may emerge later in children with developmental disabilities (Adamson, Bakeman, Deckner, & Nelson, 2012).

Early language intervention provides a critical opportunity to assuage communication difficulties that impede development (Ronski & Sevcik, 2005; Ronski et al., 2010), and in turn strengthen the caregiver-child relationship (Lesack, Bears, Celano, & Sharp, 2014). Augmentative and alternative communication (AAC) is a means to enhance language, facilitate communication attempts and encourage the spoken language of young children with developmental delays (Branson & Demchak, 2009; Broberg, Ferm, & Thunberg, 2012; Ronski

et al., 2010; Ronski et al., 2009). According to the American Speech-Language Hearing Association (ASHA), AAC includes all forms of communication (other than oral speech) that is used to express thoughts, needs, wants, and ideas. Understanding the relationship between parental responsivity and language outcomes in children who use AAC may provide more information regarding the role of the caregiver in effectively enhancing communication. The shift towards more family-centered interventions (Yoder & Warren, 2002) and the success in teaching parents to be more responsive (Brady, Warren, & Sterling, 2009; Warren & Brady, 2007) highlights the importance of parent-coached interventions (Fidler, 2005; Smith et al., 2011; Kaiser, Roberts, & Hampton, in press).

### **1.1 Maternal Responsivity**

The parent-child dynamic is imperative in fostering growth and development in early childhood (Fenning, Baker, Baker, & Crnic, 2014; Fitzgerald, Hadley, & Rispoli, 2013; Kaiser & Roberts, 2013; Warren, Brady, Sterling, Fleming, & Marquis, 2010). This relationship is critical for children whose development is atypical because of the difficulty in communicating their needs and having those needs met (Siller & Sigman, 2002; Yoder, 1986). A wealth of empirical evidence has shown that maternal responsivity is critical to child development (Brady, Warren & Sterling, 2009; Broberg, Fern, & Thunberg, 2012; McDuffie & Yoder, 2010; Sameroff & Chandler, 1975; Yoder & Warren, 2001). As well, social interactions between mother and child that promote positive and reciprocal social behaviors facilitate language acquisition (Bornstein & Tamis-LeMonda, 1997; Siller & Sigman, 2008).

### *1.1.1 What is Maternal Responsivity?*

Maternal responsivity is a facet of parenting style that incorporates an amalgam of parental behaviors affecting all aspects of development. That is, maternal responsivity is a part of an even larger scheme of behaviors that contribute overall to parenting a child. Maternally responsive behaviors are characteristics of parenting style across *all* cultures (Bornstein, Tamis-LeMonda, Hahn, & Haynes, 2008). According to the literature, for a mother to be considered responsive, she must not only attend to her child's essential, biological needs but other important aspects of social development. Infants are completely dependent upon the attention and nurturing that mothers provide as they are growing. The mother is the most important and ever-present social partner the child has and largely provides all aspects of care and the shaping of prosocial behaviors that allow children to not only function in the world, but regulate their immediate environment. Thus, maternal responsivity affects biological, emotional, psychological, *and* language development (Adamson et al., 2012; Leigh, Nievar, & Nathans, 2011; Warren & Brady, 2007). Warren et al. (2010) noted that maternal responsivity promotes a healthy, cultivating relationship between mother and child. As well, Landry, Smith, Swank, Assel & Vellet (2001) found that early maternal responsivity, in the first year of life, is strongly correlated with developmental levels at age 3. They noted that reciprocal and responsive parenting in the first year of life most significantly related to parenting style and child outcomes and this has been heavily supported in the literature (Feniger-Schaal & Oppenheim, 2012; Guralnick & Albertini, 2006; Hudry et al., 2013; Landry et al., 1998; Patterson, Elder, Gulsrud, & Kasari, 2013; Siller, Hutman, & Sigman, 2013; Spiker, Boyce, & Boyce, 2002; Tamis-LeMonda, Bornstein, & Baumwell, 2001; Warren et al., 2010). Active and appropriate responsivity requires fostering and supporting the overall child through focusing the child's

attention and developing communication (Haebig, McDuffie, & Weismer, 2013). This support builds upon joint attention, which is essential to parental responsivity and child language acquisition. It is important to note that the parent-child dynamic may be affected by atypical development, in particular atypical language development (Adamson, Bakeman, Deckner, & Ronski, 2009; Feniger-Schaal & Oppenheim, 2013).

For the purpose of this study, parental responsivity was measured in response to child communicative acts. Brady et al. (2014) stated that vocabulary corresponds to other aspects of language development and can be a useful tool in assessing overall language for children who primarily communicate via one-word utterances. Therefore, parents' responsive behaviors (parental responsivity or component behavior management) in this analysis were largely evaluated by the type of behavior (responsive or directive) and the frequency of responsiveness, expressed interest, modality (spoken or augmented), and function of the response communicated to the child. Their responses will be stimulated by interactions with the child and dependent upon the child's communicative attempts (initiations or responses), behaviors, and/or affect (Lloyd & Masur, 2014).

### ***1.1.2 Characteristics of Maternal Responsivity.***

Like other aspects of communicative behavior, maternal responsivity can be characterized on a continuum ranging from high to low responsiveness. High and frequent responsivity is most beneficial to positive child development. A responsive style in the middle of the range is not particularly harmful or detrimental to child development while being on the low or unresponsive end of the range may be. However, research has shown that employing more restrictive/directive styles of communicating do not positively contribute to language development (Marfo, 1986; McCathren, Yoder, & Warren, 1995). A highly responsive parent

would be performing at what Warren and Brady (2007) called the most "molar" level (i.e., seeking out and utilizing resources and services for their child). Again, many mothers may fall in the middle of this continuum with a less general, molar form of responsivity that is generally characterized by sensitivity and positive affect and has positive effects on development.

Brady et al. (2006) found that facilitative interaction styles, that positively shaped behavior and encouraged social-communication, significantly predicted children's communication; they used more words and had larger mean length of utterances (MLU). Sustaining the mother-child dynamic requires stability in sensitivity, a facet of maternal responsivity, and other responsive behaviors; as well, the mother's behaviors should be contingent upon the child's acts of initiation so the child is able to map an appropriate response to specific behaviors.

### *1.1.3 Contributors to Maternal Responsivity.*

Additional contributors toward maternal responsivity are stress and perceptions of their child's abilities that may contribute to potential between-groups differences regarding parental responsivity. Bronfenbrenner (1986) constructed a picture of the importance of understanding the impact of environment on familial processes. As well, the correlations between language skills and parental behavior and the effects of social class are supported by the extant literature (Goldin-Meadow et al., 2014; Guralnick, 2008; Hudry et al., 2013; Warren et al., 2010). Specifically, there are differences in reports of parental stress across racial and ethnic groups that may speak to cultural differences in the perceptions mothers have about the quality and effect of parent-child interaction, as well as, the relations between parenting experiences or differences in the parent-child relationship in a broader social context (i.e., access to services, social support,

etc.). This is important information regarding the influences outside of the parent-child relationship that affect parental responsiveness and perceptions.

Bronfenbrenner (1986) focused on the impact of external environment on intrafamilial processes. As noted above, racial and cultural differences have the potential to additionally affect the parent-child dynamic and in families of children with developmental delays, these processes may be especially sensitive or magnified when coupled with the challenges of internal (intrafamilial) processes. While this population is unique, it is possible that it is not the within family structure that dictates the manner of or precedes these processes, but perhaps the interaction between intra-familial processes and external stimuli.

#### ***1.1.4 Maternal Responsivity and its Relationship to Language.***

As previously mentioned, children with developmental delays often have social-communication deficits (Adamson et al., 2012; Branson & Demchak, 2009; Broberg et al., 2012; McDuffie & Yoder, 2010) that make it difficult for them to communicate their needs. These deficits may render them unable to understand the world around them and to be understood. Thus, they often become frustrated when they do not have their needs immediately met. Mothers interact most frequently with their children (DiCarlo, Onwujuba, & Baumgartner, 2014), so it is important that they are equipped to provide their children with the optimal ability to express themselves. This flow of communication benefits both the child and the mother. For mothers of children with developmental and/or language delays, they may interact through multiple modes of communication (e.g., sign language, speech-generating devices, or gesture).

Maternal responsiveness is tied to expressive language development in the second and third years of life (Leigh et al., 2011). In a study assessing the relationship between parent (mother and father) verbal responsiveness and the language skills of young children with autism, Flippin

and Watson (2015) found that maternal responsivity was significantly correlated with child cognition as measured by the Visual Reception subscale on the Mullen Scales of Early Learning (MSEL; Mullen, 1995) but not the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000) calibrated severity scores (CSS). Haebig et al. (2013) state that during joint attention, the word sharing from parent to child may facilitate the earlier stages of word learning by providing labels that map directly onto symbols or objects of attention. This shows the direct path through which mothers impact language learning. As well, high levels of early maternal responsivity are thought to provide early and consistent teaching opportunities of prosocial behaviors like behavioral regulation (DiCarlo et al., 2014; Landry et al., 2001). Behavioral regulation then encourages the child to comfortably express themselves.

According to Kuhl (2010) during this social interaction time, sharpened attention and arousal, in typically developing children, may provide an increase in the quantity and quality of speech information that toddlers can encode and remember. Knowing how attention and arousal stimulates language provides critical information regarding the direct influences on language and socio-emotional development and what separates the fluidity of the learning process between typically and atypically developing children. Knudsen (2004) noted that social experiences (e.g., communication) affect the 'architecture' of brain circuits and behavior in many important ways. Consistent and appropriate interaction furthers development through attachment and bonding (between mother and child), the child imprinting him or herself on the individual (i.e., seeing themselves in the individual), and recognition of the person as a stable presence who would satisfy his or her basic expectations (Bornstein & Tamis-LeMonda, 1997). Through this experience, the exchange of social stimuli leads to the aforementioned structural and functional changes in the brain (Parsons, Young, Murray, Stein, & Kringelbach, 2010; Swain, Lorberbaum,

Kose, & Strathearn, 2007). Social interaction is connected to language learning and can activate brain mechanisms that enhance the representation of the self between self and others.

## **1.2 Maternal Responsivity and Developmental Delay**

Many parents of children with disabilities do have positive perceptions regarding their children and have healthy, productive coping strategies in response to parenting challenges, but they still report experiencing higher levels of parenting stress compared to parents of typically developing children (Blacher & Baker, 2007; Hastings, Allen, McDermott, & Still, 2002; Peer & Hillman, 2012; Smith et al., 2011). These higher levels of stress are linked to a number of negative outcomes that affect health and well-being for both children and parents, including poor parent physical and mental health, marital problems, less effective parenting practices, and child psychopathology and behavioral problems (Briggs-Gowan, Carter, Skuban, & Horwitz, 2001; Kersh, Hedvat, Hauser-Cram, & Warfield, 2006).

High levels of maternal responsivity are highly correlated with secure emotional attachment later in life (Ainsworth & Whittig, 1969; Meaney, 2001; Sparrow, 2013; van IJzendoorn et al, 2007). According to Yoder and Warren (1998), high responsivity occurs when parents respond to 57% or more of child communication attempts, as this was the point at which there was positive interaction effects between parent and child. Unresponsive maternal responsivity is associated with insecure attachment and poor socio-emotional development. Research literature regarding responsivity posits that parents of children with developmental delays are not considered to be any less responsive than parents of typically developing children but they may adopt a more directive parenting style (Blacher, Baker, & Kaladjian, 2013; Hyche, Bakeman, & Adamson, 1992; Kasari, Sigman, Mundy, & Yirmiya, 1988; Medeiros & Cress, 2016; van IJzendoorn et al., 2007).

Van Ijzendoorn and colleagues (2007) found parents of children with ASD to be as sensitive as parents with typically and atypically developing children in their study of parental sensitivity and attachment in children with intellectual disabilities, language delays, and typical development. The authors noted that children with ASD often display insecure attachment to their caregivers and parental sensitivity strongly influences attachment style. Additionally, Kasari, Sigman, Mundy, and Yirmiya (1988) assessed caregiver interactions with children with autism and compared that to developmentally matched children with intellectual disabilities and typically developing infants. Specifically, they found that caregivers of children with autism were similar to the other groups in responsiveness and engagement. They employed more directive behaviors, similar to those of children with intellectual disabilities, but differed in strategizing how to shape more appropriate behaviors for their children; those of mentally retarded children pointed to objects more while those of children with autism focused on physically holding their child on task. They posited that the children's specific deficits influenced the differences in responsivity across the three groups. Combined with previous misconceptions about a lack of maternal sensitivity and insecure attachment style in mothers of children with ASD, both of these findings contributed to the literature in parental responsivity and developmental disabilities.

Warren and colleagues (2010) conducted a longitudinal study, in 55 mother-child dyads, of the relationship between early maternal responsivity and child communicative outcomes in young children with Fragile X syndrome. Childhood Autism Rating Scale (CARS; Schopler, Reichler, & Renner, 1988) total scores of 26.9 and 22.3 and MSEL composite score of 52.9 and 71.1 and were observed for boys ( $N = 44$ ) and girls ( $N = 11$ ), respectively. Data were collected at three time points; at baseline children were between 11 and 48 months of age, at time-point two

when they were between 26 and 64 months, and the final time-point when they were between 40-76 months. They recruited a fair amount of socioeconomic variability (i.e., maternal education and income) but a weak spread of racial diversity. The investigators found that early maternal responsivity proximally predicted the level of rates of total communication and number of different words used and distally predicted receptive and expressive language development at 36 months of age, after controlling for child developmental level and autism symptomology. Brady and colleagues (2014) extended the Warren et al. (2010) study and found that sustained maternal responsivity significantly correlated with improved receptive and expressive vocabulary and rate of different words produced, even after controlling for developmental level, through age nine.

Understanding the dynamic between directive and responsive parental behaviors and its impact on language development in children with greater communication needs or developmental delays is imperative. Medeiros & Cress (2016) assessed maternal directive and responsive behaviors for 25 mothers and children ( $M = 23.25$ ,  $SD = 10$ ) with complex communication needs during play with familiar and unfamiliar toys. The authors assessed the degree of relation between caregiver behavior and child's language scores. Children had a standard score below 85 on the Preschool Language Scale-4 (PLS-4) Expressive Communication subtest (Zimmerman, Steiner, & Pond, 2002), fewer than 10 spoken words on the Communication and Symbolic Behavior Scales (CSBS) Communication Temptations subtest and produced at least one intentional communication act for behavior regulation. The dyads engaged in play, at their homes, with familiar (their own chosen toy) and unfamiliar toys. Unfamiliar toys were matched to familiar toys using a toy categorization system developed by Jaeger, Miedl, and Hupp (1989). They assessed mean rate of maternal behaviors for four play types: familiar play, unfamiliar play, familiar play + SGD, and unfamiliar play + SGD. There was a significant main

effect for responsivity by activity type; mothers were significantly more responsive during familiar play contexts (with and without SGD) than unfamiliar play contexts. There were no significant differences by activity type for directiveness. The investigators included the SGD to assess the under-evaluated aspect of AAC use and the potential effects on natural responsive and directive behavior patterns in parents of children with complex communication needs. As well, they reported that there were no direct indications that SGD increased task complexity for the mothers or that mothers believed activities including the SGD to be more challenging than similar activities without the SGD.

Slonims and McConachie (2006) compared the maternal behaviors between mothers of children with Down Syndrome and mothers of typically developing children and found they were equally responsive to their babies in early infancy (8 weeks of age); despite the fact that the babies with Down Syndrome were significantly less communicative and active than their typical counterparts. However, by 20 weeks of age mothers of children with Down Syndrome were less sensitive than mothers of typically developing children. These accounts highlight the importance of early and sustained maternal responsivity on development, especially for children with developmental delays.

Assessing the parent-child dyad, for children with intellectual disabilities, from the view of the transactional model would likely illustrate an eventual decline in child's and parent's initiation rates and lead to less exchanges over time for. It is likely that the parent being unable to interpret the child's intentions and respond appropriately would lead to frustration in both parties. Understandably, this can lead to a less warm and reciprocal social exchange between parent and child, because the child is unresponsive to it, and a more inflexible and authoritative approach to parenting (Bornstein & Tamis-LeMonda, 1997; Warren & Brady, 2007). This may potentially

affect the input the child is receiving, in that there will be less sharing and fewer opportunities for acquiring new vocabulary and shaping language and behavior. In combination with the child's disability, low maternal responsivity is even more likely to negatively affect the developmental trajectory (Brady, Warren, Fleming, Keller, & Sterling, 2014). Thus, it is vital to intervene in this process early.

Yoder, McCathren, Warren, and Watson (2001) evaluated the effects of maternal responsivity on children's intentional communication acts. They found that linguistic mapping, talking about communicative referents versus descriptive talk about the child's focus point, predicted later receptive and expressive language in children, 17-33 months of age, with developmental disabilities. As well, nonlinguistic responses (e.g., pointing or physical sharing) to intentional communication predicted later intentional communication efforts, receptive vocabulary, and intelligence in children with developmental delay. In addition, nonlinguistic responses also encouraged means-end learning (understanding one's actions by understanding that of others) which also contributes positively to language learning. Yoder and Warren (1999) also found that maternal responsivity mediated the relationship between pre-linguistic intentional communication and later communication. Therefore, there is a strong correlation between maternal responsivity and its effects on the earliest communicative bids and language outcomes.

***Intervention for Maternal Responsivity.*** There is mounting empirical evidence to support the notion that maternal behavior can be enhanced through intervention (Adamson et al., 2012; Landry et al., 2008; Warren & Brady, 2007; Yoder et al., 2001; Yoder & Warren, 2001). DiCarlo et al. (2014) noted that interventions focused on providing mothers with the resources to respond more appropriately and contingently to infant communication through a transactional model increased positive parenting practices, perceptions, and parenting efficacy. This fosters

empowerment which likely contributes to maintenance in responsivity over time. Kaiser (2014) noted a number of language facilitation strategies that may be targeted in interventions, including ‘setting the foundation for communication.’ Setting the foundation includes a number of tools that can enhance the dyadic interaction between parent and child and encourage communication development: play and engage, notice and respond, take turns, and mirror and map. Vismara, McCormick, Young, Nadhan, and Monlux (2013) conducted a pilot telehealth parent-training study for parents of children with autism. The findings from their preliminary analysis of parental navigation of the website, as well as children’s verbal language and joint attention skills, suggested that telehealth programs and interventions may be useful in teaching and supporting parent learning. These investigations all highlight the need and advancement of parent and family-centered interventions that may further enhance language intervention for children with developmental delays.

Yoder and Warren (2002) argued that interventions have the ability to teach parents not only how to respond to child communication, but the most effective way to do so. They hypothesized that mothers (and teachers) respond more often and appropriately to intentional versus pre-intentional communication. Thus, they developed the Prelinguistic Milieu Teaching intervention which successfully increased children's generalized intentional communication and expressive language by focusing on three specific facets of maternal responsivity to child communication: compliance, imitative response, and linguistic mapping. This led to more social exchanges between mother and child, as well as, more effective communication abilities. Moreover, they found sustained treatment effects from both parties. This finding lends credence to the importance of assessing maternal responsivity in mothers of young children, especially

with developmental delay, and intervening to improve responsivity so as to positively affect the developmental trajectory.

### ***1.2.1 Measuring Maternal Behavior***

There are a number of measures that have been developed to assess maternal behavior. Appendix B shows the similarities and differences among these measures, which include rating scales (e.g., *Maternal Behavior Rating Scale*) and event-based coding schemes. All of them focus on assessing the quality of maternal interaction while engaging with their typically or atypically developing children in a naturalistic context.

### ***1.2.2 Maternal Behavior Rating Scale.***

Mahoney, Powell, and Finger (1985) developed the *Maternal Behavior Rating Scale*, a global rating scale that assesses the quality of maternal interactive behavior with young children with intellectual disabilities. In 1986, they developed a 7-item short form of the scale to better assess maternal interactive behavior due to the long-standing difficulty in evaluating the efficacy and reliability of interventions aimed at improving the quality of mother-child interactions. They found that the short form (sub-items: enjoyment, sensitivity to state and interests, responsiveness, appropriate and physical stimulation, and directiveness) remained reliable towards assessing the quality of maternal interaction. This tool is particularly beneficial for evaluating the effects of intervention programs aimed at modifying maternal behavior. It has been used in a number of studies that assessed maternal responsivity (Kim & Mahoney, 2004; Lee, McCreary, Breitmayer, Kim, & Yang, 2013; Mahoney & Neville-Smith, 1996; Vismara et al., 2013).

### *1.2.3 Responsive Augmentative and Alternative Communication (AAC) Style scale.*

Broberg, Ferm, and Thunberg (2012) developed the Responsive AAC Style scale (RAACS) Version 2 as part of a larger scale early AAC intervention, AKKTiv, which developed and evaluated courses for parents of children with communicative disabilities. The research aim was to develop and evaluate a measure that could be used to assess parental responsivity while engaging with children with an array of medical conditions who use AAC. Parental responsivity was assessed before and after parents participated in ComAlong, a training course on using responsive communication and AAC to support interaction with children. Thirty-seven parents (20 mothers and 17 fathers;  $M_{age} = 35$  years) and 28 children (15 girls and 13 boys;  $M_{age} = 48$  months) participated in the study. The investigators found that parents who participated in ComAlong showed a significant increase in their RAACS scores, while parents who did not participate showed no change in their RAACS scores. The authors noted that there was no coding scheme or mechanism established to assess AAC interactions, making it difficult to assess the external validity of the measure. The scale was developed in concordance with the AAC research to identify established parent behaviors associated with a responsive communicative scale.

The scale and associated assessments were created to meet seven criteria: (a) interactions that were ecologically valid and fun to the parent and child, (b) short interaction times, (c) assessment of parental use of responsive communication behaviors established as important by AAC literature, (d) assessment of parental use of responsive communication style behaviors and parental strategies for using and facilitating AAC, and (e) a component of assessment for affective tone in interactions, (f) the scale needed to possess standard psychometric qualities, and

(g) a reliable coding scheme devoid of extensive training that wouldn't be easily understood by laypersons.

The RAACS scale does not provide strong external validity and does not specifically code for child communicative acts. The inclusion of child communicative acts was particularly pertinent to our study as we were attempting to understand the relationship between parental responsivity and language outcomes in children with significant developmental delays; the child's social role paints a clearer picture of the existing dynamic between parent and child. This led us to use an adaptation of Warren et al.'s event-based coding scheme.

#### ***1.2.4 Event-based Coding Schemes.***

The event-based coding schemes focus on utterances made by mothers and coding specific acts of maternal behavior to present a larger picture of parent-child interaction (similarly done in a number of maternal responsivity studies). Communication acts can and will include gesture, words, manual sign, and symbols. Landry et al. (1998 & 2001) developed a coding scheme that was a source of inspiration for the coding scheme later developed by Warren et al. (2010). Warren and colleagues were primarily focused on spoken communication between children with Fragile X and their mothers. In the event-based coding scheme of Warren et al. (2010), coders watch videotapes of language intervention involving mother and child. To provide the most naturalistic context, the intervention was done at home and divided into four, five minute- interactional contexts: reading a book, snack time, unstructured play with toys chosen by the child, and a 30-min naturalistic sample (parents guided in undertaken an everyday activity). Every utterance made by the mother and child is transcribed. This information may be used in a variety of means (e.g. measuring turn-taking, vocabulary, mean length of utterance) to assess maternal and child behavior in a number of given contexts. Many studies that have evaluated the

effects of maternal responsivity on child language development have used child vocabulary as an outcome variable (Broberg et al., 2012; Siller, Hutman, & Sigman, 2013; Tamis-LeMonda et al., 2001) as it has long been considered to be strongly correlated with environmental contexts (e.g., parenting, intervention). An event-based coding scheme was utilized in our study because it has shown strong reliability in previous maternal responsivity studies (e.g. Warren et al., 2010 and Landry et al., 1998 & 2001) and takes into account parent and child responses, as compared to the aforementioned parental responsivity measures.

### **1.3 Language Intervention**

Efforts have been made to intervene early and possibly change the course of development by lessening the severity of communication and social skill deficits (Fey et al., 2006; Goldin-Meadow et al., 2014; Guralnick, 2005). This is essentially done by modeling appropriate behavior consistently, so as to promote familiarity and shape behavior, and using language to label objects of shared attention (Binger, Berens, Kent-Walsh, & Taylor, 2008; Bornstein, Tamis-LeMonda, Hahn, & Haynes, 2008; Siller & Sigman, 2002). Mothers are often the most fundamental source for facilitating such skill development (Paavola, Kunnari, & Moilanen, 2005), especially language acquisition (Brady, Warren, & Sterling 2009; Haebig, McDuffie, & Weismer, 2013; Yoder & Warren, 1998). Thus, evaluating parental responsivity, separate from other aspects of the intervention protocol, may provide some additional insight regarding the functional vocabulary outcomes of children with developmental delay and few spoken words.

#### ***1.3.1 AAC and Language Interventions.***

AAC incorporates low-tech, like the Picture Exchange Communication System (PECS), and high-tech options, like Proloquo To Go (iPad application) and TechTalk. The high-tech

options are often Speech Generating Devices (SGD) that provide output, as in Ronski et al. (2010). According to van der Meer and colleagues (2012), most children with developmental disabilities show a preference for using SGDs. AAC can augment words for an individual who is not speaking or has limited spoken language abilities. AAC provides the opportunity to express *and* receive language for these individuals. The user (child or social partner) can point to or click on an individual symbol or formulate sentences that represent their needs or thoughts. Along with potentially enhancing communication; AAC contributes to increased joint engagement, another critical aspect of language and cognitive development (Benigno & McCarthy, 2012). The majority of AAC research to date has focused on children four or older and there are relatively limited studies on children under three (Branson & Demchak, 2009; Ronski, Sevcik, Barton-Hulsey, & Whitmore, 2015).

Kasari and colleagues (2014) examined the effect of beginning a blended, adaptive treatment design with an SGD in improving spontaneous, communicative utterances (SCUs) in 61 school-aged (5 to 8 years), minimally verbal children with autism over 36 weeks. The investigators combined two communication-focused interventions for preschool children, JASPER (JASP; Joint Attention Symbolic Play Engagement and Regulation) and EMT (Enhanced Milieu teaching). JASP focuses on the development of prelinguistic gestures and play skills within play-based interactions to increase joint engagement between adult and child with ASD and EMT uses responsive interaction and systematic modeling and prompting to encourage spontaneous, functional spoken communication. Children were assigned to two, 12-week stages: Stage one- JASP + EMT *or* JASP + EMT + SGD, they were then assessed as early (stayed in same treatment) versus slow responders (moved on), and stage two- slow response to JASP + EMT + SGD began intensified version *or* slow response to JASP + EMT re-randomized to

intensified JASP + EMT or JASP + EMT + SGD. They found improvements in spontaneous communicative utterances, novel words, and comments in children who began with the JASP + EMT + SGD condition as opposed to spoken word only, JASP + EMT. Additionally, they found that slow responding children who began with JASP + EMT + SGD, benefitted from intensified JASP + EMT + SGD. The authors concluded with the finding that minimally verbal school-aged children are able to make significant and rapid gains in spoken spontaneous language with a blended intervention focused on joint engagement, play skills, *and* an SGD.

Romski and colleagues examined the language performance of toddlers with developmental delays and fewer than 10 spoken words. The participants were randomly assigned to one of three language interventions: two augmented, Augmented Communication-Input (ACI) and Augmented Communication-Output (ACO), and one spoken, Spoken Communication (SC), using a stratified randomization procedure to control for gender, race, and medical etiology. The two augmented interventions utilized an SGD. At post-intervention, all children in the ACO and ACI intervention groups used augmented and spoken words for the target vocabulary items, while children in the SC intervention only produced a very limited number of spoken words. Vocabulary size was substantially larger for ACO and ACI than for SC groups. Child mean length of utterance in morphemes ( $MLU_m$ ), mean length of turn, and total turns increased from pre- to post-intervention for all children. Parent  $MLU_m$  and total turns also increased, while  $ML_{turn}$  decreased. Only parent  $MLU_m$  did not show a significant session effect.

Romski et al. (2010) found that AAC positively affected vocabulary growth *and* did not hinder speech development. Moreover, Romski and colleagues found that augmented language interventions that include parent coaching can have positive effects on communicative ability in toddlers with developmental delay who begin with fewer than 10 spoken words. This finding

highlights the positive impacts that parental responsive behaviors may have on language when augmented by an SGD. There are few studies that have assessed the relationship between parental responsivity and AAC use (Broberg et al., 2012; Medeiros & Cress, 2016), even though an increasing number of families and children are using AAC as a means of communication. It is important to further examine this relationship and its potential effects on language outcomes.

#### **1.4 Research Questions**

The purpose of this study was to assess the relationship between parental responsivity and language outcomes (spoken or augmented) after a parent-implemented language intervention for children with significant developmental delays and fewer than ten spoken words. The observed interactions between parent and child were part of a longitudinal study of language development by Ronski et al. (2010). Data and transcripts from the baseline assessment and the 24th intervention session (approximately twelve weeks later) were used. Two questions were asked:

1) How does parental responsivity change over the course of the language intervention and intervention groups? We hypothesized that parents across all intervention groups would be more responsive at post-intervention as compared to pre-intervention. This hypothesis was based on the significant amount of research stating that language intervention can enhance maternal responsivity (Brady, Warren, & Sterling, 2009; DiCarlo et al., 2014; Dyches, Smith, Korth, Roper, & Mandelco, 2012; Landry et al., 2008; Warren & Brady, 2007; Yoder & Warren, 2001). By learning how to better communicate and interpret their child's needs throughout intervention, parents may be better equipped to respond contingently to their child's needs. Also, the enhanced communicative gains on the child's part will aid the parent's ability to respond to their child.

Moreover, we hypothesized that parents in the augmented language intervention (ACO and ACI) would be more responsive and less directive because it was expected that parents of children in the augmented groups will have a unique opportunity to be contingently responsive to their needs, as the device may act as a middleman during their dyadic interaction.

Furthermore, it was hypothesized that parents in the ACO intervention would have more positive and contingent, versus directive, responsivity than those in the ACI intervention.

Broberg et al. (2012) noted that the direct modeling done by social partners using AAC is as important to facilitating language as it is to responsive behaviors due to the reinforcement and teaching opportunities it provides. This hypothesis is largely based on the notion that AAC may be a mode of expressive communication for children with significant developmental delays.

2) What is the relationship of parental responsivity to toddler target expressive vocabulary gains, at post-intervention, across spoken *and* augmented language interventions? We hypothesized that at post-intervention contingent and appropriate parental responsivity would positively correlate with greater language gains in children across interventions. This hypothesis was based on the extant literature that noted that maternal responsivity facilitates language growth over time (Bornstein & Tamis-LeMonda, 1997; Leigh et al., 2011).

## 2 METHOD

### 2.1 Study Design

This study was a secondary data analysis that utilized data from a randomized control treatment intervention trial (Ronski et al., 2010). The present study examined the relationship between parental responsivity and target vocabulary outcomes in a total of 62 parent-child dyads who participated in a longitudinal study of language intervention for toddlers with significant developmental delay and fewer than ten spoken words. The performance of the children and their parents was assessed. Information on participants, assessments, and interventions is as was presented by Ronski et al. (2010).

### 2.2 Participants

The original study participants were recruited from 45 sources in the metropolitan Atlanta area. Such sources routinely service children who could meet the study criteria. These sources included: early intervention services, private speech-language pathologists (SLPs), clinical psychologists, developmental pediatricians, and pediatric neurologists. The recruitment sources provided parents with information, through a flyer, about the study. If parents were interested, they contacted the project to discuss the child's profile and to meet with the principal investigator and the project's coordinating SLP to further assess qualification. Parents who came in for this secondary meeting were provided with consent forms by study personnel and told their information would be de-identified and stored in a password encrypted database. The more identifiable information (e.g., name, etc) was only accessible to the PI and SLP. They were told that their sessions would be videotaped and transcribed by staff trained in confidentiality procedures. They were informed that the intervention would include 24 sessions, generally about

12 weeks, and that they would participate in assessment follow-up visits in the lab at 3, 6, and 12 months.

### ***2.2.1 Toddlers.***

The current study was comprised of sixty-two toddlers (43 boys, 19 girls; mean age = 29.60 months, range from 21 to 40 months) with significant developmental delay and fewer than 10 spoken words who completed the intervention from the original study. Less than ten spoken words was defined in the original intervention as an observed score of less than 12 months on the Expressive Language Scale of the Mullen Scales of Early Learning [MSEL] (Mullen, 1995). The sample included children from African American ( $N=18$ , 29%), Asian ( $N=7$ , 11%) and Caucasian ( $N=37$ , 60%) backgrounds. The medical etiologies in the sample included genetic syndromes (e.g. Down Syndrome), seizure disorders, cerebral palsy, and unknown causes.

### ***2.2.2 Parents.***

Sixty-two parents (58 mothers, 4 fathers; mean age = 37.33 years;  $SD = 4.73$ ) also completed the intervention. Table 1 summarizes the parents' demographic information.

*Table 2.1 Parent Demographic Information*

	n	%
Gender		
Male	4	9.7
Female	58	90.3
Race		
White	39	62.9
Black or African American	18	29.0
Asian	5	8.1
Education		
High school	6	9.7
Some college	8	12.9
Bachelor degree	25	40.3
Graduate or professional degree	21	33.9

## 2.3 Procedures

### 2.3.1 Assessments.

Prior to beginning the original study's intervention, the toddlers were assessed using the Mullen Scales of Early Learning (Mullen, 1995) to obtain a measure of early development. They were also administered the Sequenced Inventory of Communicative Development Inventories (SICD), MacArthur Development Inventories (CDI), and Clinical Assessment of Language Comprehension (CALC). All of the administered assessments are well-formed and widely utilized for their comprehensive evaluation of various domains of development (i.e., communication, visual-spatial intelligence, social and daily living skills). Parents completed a battery of questionnaires and forms pertaining to stress, perceptions of language development, and their child's history. The CDI and SICD were re-administered at post-intervention.

### **2.3.2 Interventions.**

After the completion of pre-intervention measures, the parent-child dyads were randomly assigned to one of three language intervention groups: Augmented Communication Input (ACI), Augmented Communication Output (ACO), or Spoken Communication (SC). In the ACI intervention, the adult (interventionist *or* parent) modeled the augmented and spoken word of the target vocabulary, individualized to the child, on the SGD. There was no direct demand for the child to communicate but it was encouraged. The child received reinforcement for the use of an augmented or spoken word. For example, the parent may praise the child verbally (e.g., good job or awesome) or engage in some mode of physical encouragement (e.g., a hug or hi-five). In ACO, the adult used the SGD and required the child to produce augmented words, on the SGD. The child could be visually, verbally, or physically (hand-over-hand) prompted to use the augmented words. The SC was used as a contrast condition to the augmented sessions. In SC, children were prompted verbally to produce spoken words.

The sessions were 30 minutes each and consisted of three 10-minute blocks of play, book reading, and snack (naturalistic contexts often engaged in daily). The first eight sessions were conducted by a trained interventionist, with the speech-language pathologist (SLP) explaining the techniques to the parent as they observed. The parent joined the intervention during the ninth session and led the session by the sixteenth session. Throughout the intervention period, if participants were in an education and/or therapy program, they attended it as usual.

## **2.4 Measures**

To evaluate the current study questions, two measures were used: 1) target vocabulary outcomes at session 24 from the original study and 2) parental behavior as measured with a

coding scheme adapted from Warren et al. (2010). The coding scheme was applied using transcripts of the intervention sessions.

#### ***2.4.1 Language transcripts.***

The language transcripts and transcript data are from the original Ronski et al. (2010) study; the coding scheme was applied in addition to the existing data. We used transcripts prepared as part of the original study. The language transcripts of parent-child interactions were created using the Systematic Analysis of Language Transcripts (SALT; Miller & Chapman, 1985); the information was created from the baseline and 24<sup>th</sup> (led by the parent at home) sessions. Transcribers used an event-based scheme in order to code each utterance made by parent and child. Codes included spontaneous, augmented or spoken target vocabulary word use. Target vocabulary refers to a set of vocabulary items that was chosen by the parents and SLP and tailored to the child's interests during the three routines. The intention was to encourage the use of functional terms relevant to daily living that could also be used during the three intervention contexts (i.e., snack, play, and book). Reliability of the intervention implementation came from coding of the intervention sessions by masked, trained coders (Ronski et al., 2010). Twenty percent of the 120 transcripts ( $n = 24$ ) were selected randomly to compare the number of available target words that independent transcribers had found in the third and final version of the transcripts. There was 86% agreement in the number of identified target words across the two versions of the transcripts. The overall kappa was .97, which was described as excellent by Fleiss (1981).

#### ***2.4.2 Coding parental behavior.***

We used the language transcripts from the intervention to evaluate the parent's communication and responsivity. The coding scheme that was used was adapted from Warren et

al. (2010) and Brady et al. (2013). Unlike Warren et al. (2010), the purpose of the primary study was not to assess parental responsivity but the effects of AAC on vocabulary development. Therefore, parent's use of and acknowledgment of the speech-generating devices SGD (the study's form of AAC) use by the child was a unique addition to this coding scheme. Appendix C provides operational definitions for the way in which parental behavior and communicative acts towards the child were coded. As in Warren et al. (2010), when parent's communication includes numerous utterances in succession to the child, only the last utterance was coded. The rationale for this approach is that children would generally be attentive or respond to the parent's last utterance or communicative act.

Brady et al. (2013) conducted a principal component analysis of the Warren et al. (2010) coding scheme and found significant correlations amongst a number of the codes. The original seven codes were collapsed into two overarching categories, 1) parental responsivity and 2) component behavior management. Parental responsivity included any instances where the parent's act could be seen as introducing, maintaining, requesting verbal replies, or commenting. Component behavior management (CBM) included the more directive parental behaviors aimed at restricting, limiting, or altering the child's state which included: redirecting, requests for behavioral compliance, or zaps (i.e. parental behaviors that limit, restrict, or alter child state in some way).

Unlike Warren et al. (2010), this study utilized an SGD which was incorporated into two of the three intervention groups. Gathering information about the mode of communication provided information regarding any differences between the effect of spoken and/or augmented requests and possibly on the intervention groups themselves. Our coding scheme took into account the use of target vocabulary words and their modes (use or non-use of SGD). The Brady

et al. coding scheme notes that parental requests for an SGD response from the child are coded as requests for verbal replies and not behavioral compliance requests. This concession likely balances out treatment fidelity regarding any likelihood of ACO having more directive input than ACI. While Warren et al. (2010) did not utilize an SGD, this footnote aided our coding scheme which did include SGD. Additionally, at Session 24 we differentiated the parent's requests as either spoken, augmented, or both to account for the parents' frequency of SGD use.

### **2.4.3 Coding.**

Two raters coded the transcripts to assess the inter-observer agreement of the coding scheme. The primary rater was the principal investigator who coded all 120 of the transcripts. The secondary rater was a graduate student trained by the principal investigator who was familiar with the original study. The primary rater coded six transcripts to establish a standard for the official coding scheme. Then, before beginning the official coding process, the secondary rater was trained by using those *same* six transcripts of parent-child dyads until she reached a minimum of 80% agreement. After the secondary rater completed the training process at 80% agreement with the primary rater and the original coding scheme, the primary rater coded all of the remaining transcripts. The secondary rater then coded a randomly selected 20% of the transcripts ( $n = 24$ ). The overall kappa, for baseline and session 24, was .85, which is deemed very strong according to Fleiss (1981), with a range of kappas from .67 to .98 for parental responsivity and a range of .78 to .99 for component behavior management. Kappas of .67 and .78 are seen as strong. Table 2 summarizes the results of the analysis. While the overall score is strong ( $k = .85$ ), a large improvement in the kappa scores was noted from baseline (.67 and .78) to session 24 (.98 and .99). This increase in coding reliability may be attributed to the clarity of assessing parental behavior from pre-intervention to post-intervention. That is, within the context

of the intervention the intent of parental behavior (responsive vs. directive) may have become more salient overtime as parents become more positively and contingently responsive.

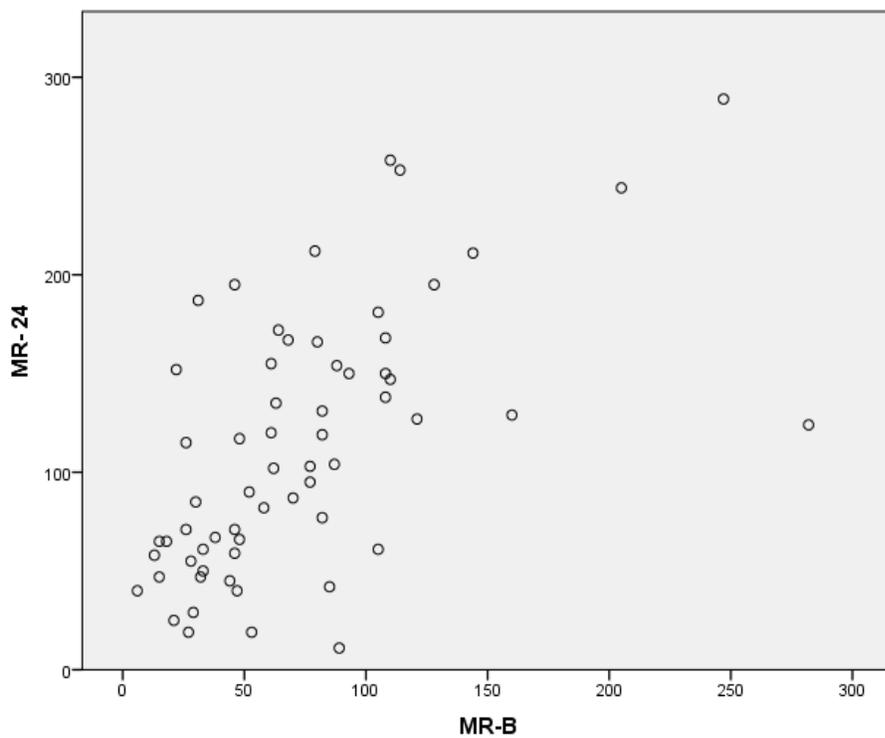
*Table 2.2 Reliability of the Challenging Behavior Codes*

Code	Cohen's Kappa
Total Across Codes	.85
Parental Responsivity- Baseline	.67
Parental Responsivity- 24 <sup>th</sup> Session	.98
Component Behavior Management- Baseline	.78
Component Behavior Management- 24 <sup>th</sup> Session	.99

### 3 RESULTS

#### 3.1 Parental Responsivity and Component Behavior Management

Instances of parental responsivity increased from pre-intervention ( $M = 74.22$ ,  $SD = 53.29$ ) to post-intervention ( $M = 112.78$ ,  $SD = 66.08$ ) and on average the instances of Component Behavior Management (CBM) decreased slightly from pre-intervention ( $M = 30.15$ ,  $SD = 19.41$ ) to post-intervention ( $M = 28.90$ ,  $SD = 14.58$ ). At post-intervention, parents in the AC-O ( $M = 125.95$ ,  $SD = 50.70$ ) intervention were the most responsive, followed by parents in SC ( $M = 108.84$ ,  $SD = 53.29$ ), and then parents in the AC-I intervention ( $M = 103.81$ ,  $SD = 70.83$ ). Parents in the SC intervention group were the most directive ( $M = 32.95$ ,  $SD = 18.03$ ), followed by AC-O ( $M = 28.25$ ,  $SD = 10.97$ ), and AC-I ( $M = 25.86$ ,  $SD = 13.96$ ). Figures 1 presents a scatterplot of parental responsivity. The figure shows a positive, upward trend and a number of outliers, which were not significant to the analysis. Figure 2 shows a scatterplot of component behavior management. There was no trend amongst the data.



*Figure 3.1 Scatterplot of Parental Responsivity*

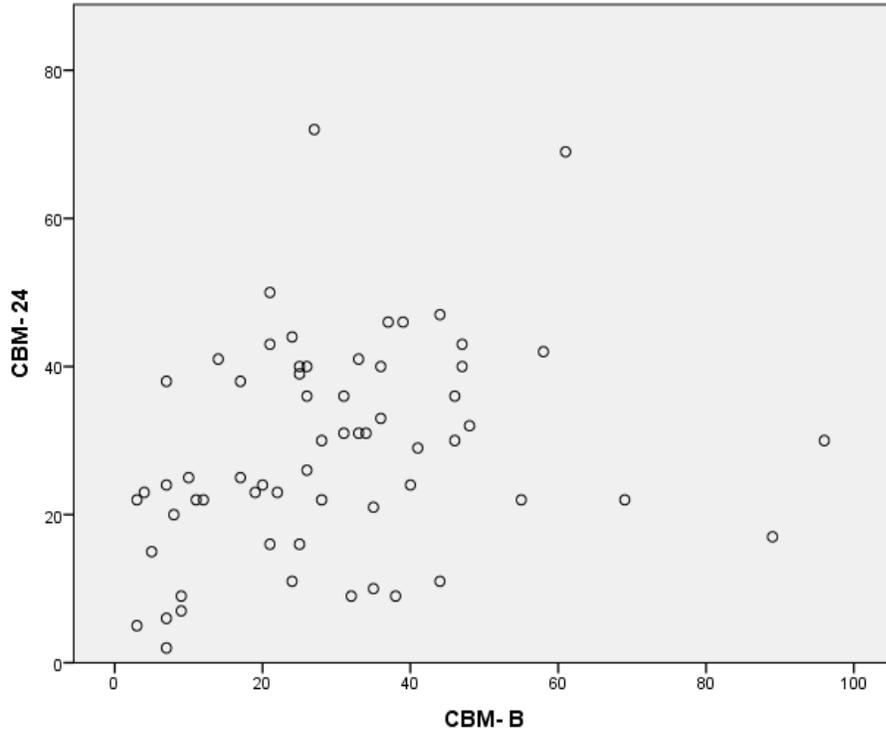
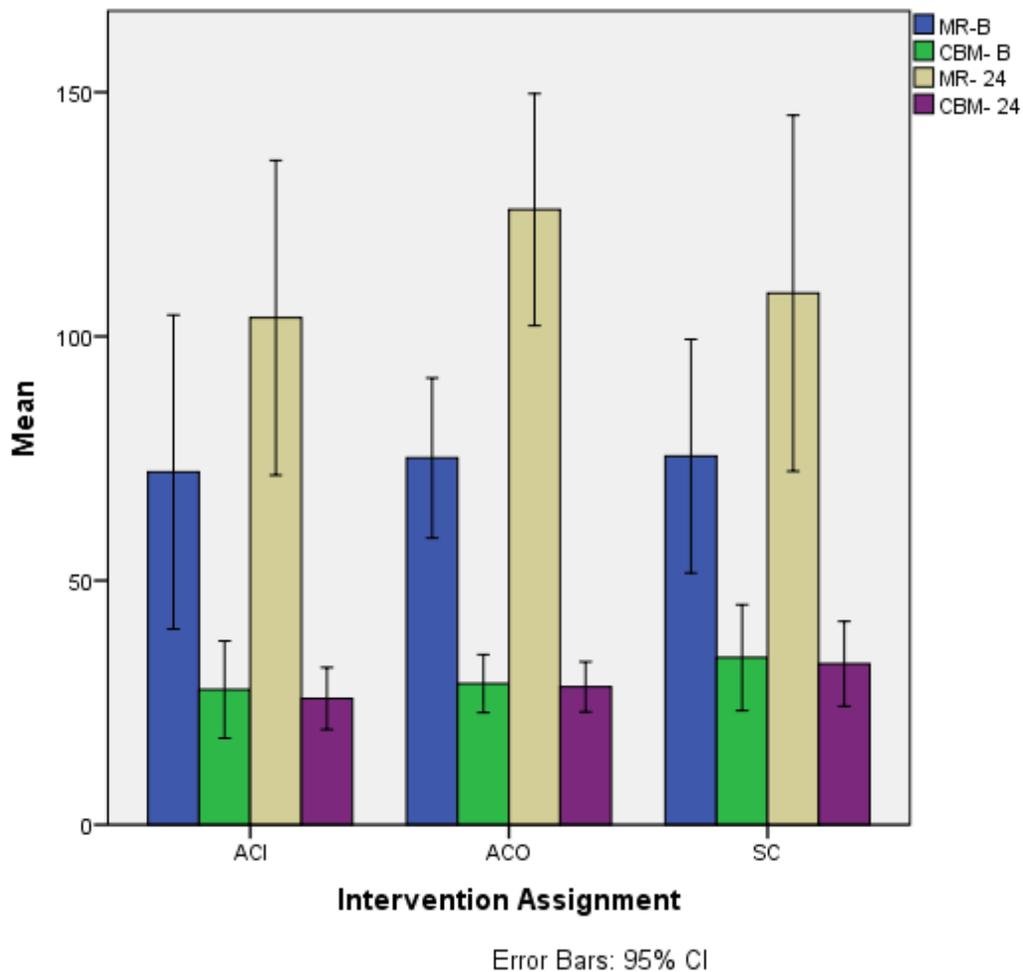


Figure 3.2 Scatterplot of Component Behavior Management



*Figure 3.3 Graph of Parental Responsivity Changes*

### 3.2 Research Question 1: Parental responsivity over the intervention

A one-way between-subjects, repeated measures ANOVA was conducted to assess the change in parental responsivity from pre- to post-intervention and across interventions and is presented in Figure 3. There was a significant main effect of time (pre, post-intervention) on parental responsivity [ $F(1,57) = 29.46, p < .001, \eta^2 = .34$ ] but not for component behavior management [ $F(1,57) = .13, p = .72, \eta^2 = .002$ ]. There was no main effect for intervention assignment and no interaction. A thorough representation of the results from the ANOVA are

provided in Table 3. Table 4 provides a statistical summary of parental behavior by intervention assignment.

*Table 3.1 Analysis of Variance for Parental Behaviors*

Variable	Baseline			Session 24			$\eta^2$	<i>p</i>
	<i>M (SD)</i>			<i>M (SD)</i>				
	ACI	ACO	SC	ACI	ACO	SC		
<b>PR</b>	69.64 (70.04)	75.10 (34.98)	75.10 (48.33)	102.05 (69.62)	125.95 (50.71)	50.71 (74.75)	.36	.000
<b>IA</b>							.013	.68
<b>PR X IA</b>							.02	.53
<b>CBM</b>	27.41 (21.34)	28.90 (12.73)	32.90 (19.32)	25.73 (13.64)	28.25 (10.97)	32.30 (17.78)	.002	.72
<b>IA</b>							.035	.35
<b>CBM X IA</b>							.001	.98

*Note.* *N* = 62; PR = Parental Responsivity; CBM = Component Behavior Management; IA = intervention assignment; standard deviations in parentheses.

Table 3.2 Parental Behavior Frequencies

Intervention Assignment			CBM- 24	MR- 24
ACI	N	Valid	21	21
		Missing	0	0
	Mean		25.86	103.81
	Median		25.00	67.00
	Mode		22	40
	Minimum		2	19
	Maximum		50	253
ACO	N	Valid	20	20
		Missing	0	0
	Mean		28.25	125.95
	Median		27.50	124.50
	Mode		24	195
	Minimum		9	61
	Maximum		46	258
SC	N	Valid	19	19
		Missing	0	0
	Mean		32.95	108.84
	Median		31.00	104.00
	Mode		22	11
	Minimum		6	11
	Maximum		72	289

### 3.2.1 Target Vocabulary

Functional target vocabulary gains at post-intervention was taken from the original study's session 24 transcripts. Specifically, we used the proportion of spontaneous combined

(augmented and/or spoken) words used by the child, or Proportion of Functional Vocabulary Use. The use of proportions correct for variability in the number of functional words used by the children across groups. The mean proportion of words used across interventions was 0.41 ( $SD = 0.34$ ). The mean proportion of functional vocabulary words for children in the ACI intervention was 0.50 ( $SD = 0.27$ ), ACO was 0.67 ( $SD = 0.25$ ), and SC was 0.05 ( $SD = 0.11$ ).

### 3.3 Research Question 2: Parental Responsivity and Target Vocabulary Outcomes

A Pearson's product-moment correlation coefficient was computed to examine the relationship between parental responsivity and functional target vocabulary at post-intervention. There was a significant, positive correlation between functional vocabulary and component behavior management for the ACO intervention and parental responsivity and component behavior management across all groups at session 24. The bivariate correlations are shown in Tables 4 and 5.

*Table 3.3 Bivariate Correlations Among Functional Vocabulary & Parental Behaviors*

Variable	1	2	3
1. Functional Vocabulary	--	.14	.08
2. Parental Responsivity		--	.60**
3. Component Behavior Management			--

Note. \*\*Correlation is significant at  $p < .001$ .  $N = 62$

*Table 3.4 Bivariate Correlations Among Functional Vocabulary Across Interventions*

Intervention Assignment	Variable		
<b>SC</b>	1	2	3
1. Functional Vocabulary	--	.35	.44
2. Parental Responsivity		--	.48*
3. Component Behavior management			--
<b>ACI</b>			
1. Functional Vocabulary	--	.08	.24
2. Parental Responsivity		--	.72**
3. Component Behavior management			--
<b>ACO</b>			
1. Functional Vocabulary	--	.22	.46*
2. Parental Responsivity		--	.69**
3. Component Behavior management			--

Note.  $N = 62$ . SC= Spoken; ACI= Augmented-Input; ACO= Augmented-Output.

\*\* . Correlation is significant at  $p < .01$ .

\* . Correlation is significant at  $p < .05$ .

## 4 DISCUSSION

An extensive body of developmental literature has suggested that parental responsiveness is strongly associated with child development, in particular child language development. The present study found that parental responsiveness showed an overall increase over the course of the intervention for parents across all three intervention groups. This finding supports one of the original hypotheses that at post-intervention parents would overall become more responsive; specifically, they would become more contingently responsive and less directive to their child's communicative needs. Our hypothesis regarding intervention group differences was not supported. It is imperative to note that Ronski et al. (2010) found that children in ACI received significantly more augmented target vocabulary input than children in ACO at session 24, which was as expected. At session 24, all three assignments were significantly different, with children in ACO receiving the most spoken input and ACI receiving the least spoken input.

### 4.1 Research Question 1: Change in Parental Responsivity over Intervention

We hypothesized that parents across all groups would become more positively and contingently responsive over the course of the intervention. Moreover, we hypothesized that parents in the augmented language interventions (ACI and ACO) would be more responsive and less directive than those in the spoken (SC) condition. We expected that the SGD would permit parents in the augmented groups to have a unique and context-specific opportunity to be contingently responsive to their needs. We also expected that parents in the ACO intervention would have more positive and contingent, versus directive, parental responsiveness than those in the ACI group. We found no significant differences in directives across all groups. We did find a positive, significant correlation between parental responsiveness and component behavior

management across groups. That is, as parents became more responsive they also became more directive. It may be that parents became more contingently responsive overall at post-intervention, therefore all instances of communicative utterances (responsivity and directives) increased. Sometimes it will be necessary for the parent to express certain directives (e.g., come here, let's play, etc.) because they will be engaging and communicating more with the child and must sometimes direct the activities. The parent will also need to stimulate transitions or manage some behaviors (e.g., don't toss the book, don't chew the toy, etc.).

More specifically, as noted by Ronski et al. (2010) there was an increase in turn-taking and total turns which resulted in a greater and enhanced dyadic interaction. Thus, we can expect there to be an increase in the quantity or frequency of both parental responsivity and component behavior management. As well, the gap between parental responsivity and component behavior management increased because parents showed a significant increase in positively responsive behaviors but did not increase in directiveness. Parents were already significantly less directive than they were responsive so the increased difference was expected as responsivity increased.

The results from the present study suggest that at the end of the intervention parents were more responsive to their children's communicative acts than when they first began the intervention. While there was a slight overall decrease in component behavior management (CBM), contrary to the increase in parental responsivity, it was not significant.

#### **4.2 Research Question 2: Parental Responsivity and Target Vocabulary Outcomes.**

We hypothesized that at post-intervention, contingent and appropriate parental responsivity would positively correlate with greater language gains in children across the three interventions. Having target vocabulary specifically chosen by the parents to represent things familiar to the children during naturalistic routines likely fostered a more familiar or routine

interaction and play dynamic than having the vocabulary chosen for them by the principal investigator. This sort of clarity in interpreting their child's needs or communicative attempts presented a direct opportunity for parents' responses to be contingent to child requests. This contingency, in turn, is more likely to be embedded into the parent-child routine in the future than words and situations that were unfamiliar.

Only for the ACO intervention was there a correlation between the proportion of functional vocabulary and component behavior management, meaning that higher functional vocabulary was associated with increased directiveness. In addition to the ACO intervention's larger functional vocabulary outcomes post-intervention, this intervention protocol may have provided more opportunities for turn-taking between parent and child thus facilitating increased vocabulary and resulting in more opportunities for parental responsivity *and* directives.

### **4.3 Limitations**

There were some limitations that must be considered. Using videotapes in addition to the transcripts may have contributed further information regarding the parent-child interaction. As well, our sample size was relatively small; although, it is representative of sample sizes in the relevant literature for children with developmental delays.

### **4.4 Future Research Directions**

These results stress the importance of parents being contingently and positively responsive to their children, especially in the context of using and teaching their children AAC. In the future, longitudinal research in language interventions, that include parents or families, may not have to include an additional study component to target and enhance parental responsivity; rather, it may be combined alongside other aspects of language and/or AAC

intervention and it should be assessed to determine if this enhanced responsivity is maintained over time. As well, it would be beneficial to assess the quality of directive behaviors and their impact on overall parental responsivity. Baseline differences in parental responsivity among parents of typically and atypically developing children, who have not yet received intervention or do not use AAC, could also be assessed to provide further insight regarding any similarities and differences during parent-child interaction, especially within AAC use. This may further inform responsivity and language intervention protocol.

Additionally, it would be most beneficial to ensure culturally competent intervention practices that cater to diverse families within AAC and family-centered interventions (Binger et al., 2008) as noted by the American Speech-Language-Hearing Association (2000). The Ronski et al. (2010) intervention was conducted in metropolitan Atlanta and included an ethnically diverse sample, as noted previously. The cultural component may optimize long-term language outcomes for children with developmental delay who use AAC and could be viable, qualitative information for researchers and parents, if they are involved with intervention implementation.

#### **4.5 General Discussion**

This study contributes to the literature on both augmentative and alternative communication and parental responsivity in three major ways. First, this study is one of a select few that investigates the relationship between parental responsivity and communicative outcomes in children who use AAC. There are few studies (Broberg et al., 2012; Medeiros & Cress, 2016) that have focused on this specific population, children who use AAC, when studying parental responsivity. As well, the present study arose from an intervention that compared the language outcomes across 3 different intervention assignments. This potentially provided further detail about the impact on the outcome differences in the ACI, ACO, and SC

groups. Secondly, the findings from this study highlight the impact of parental responsivity on parent-coached intervention implementation as there has been a long-term focus and emphasis on the importance of early intervention. Finally, the study specifically assessed differences among parental pattern behaviors (i.e., directives *and* responsivity) with and without the use of an SGD, which as highlighted in Medeiros & Cress (2016) has been an understudied area in the realm of parental responsivity and language development in children with developmental delays and complex communication needs. As well, our study included 4 fathers where most of the literature has been primarily on maternal responsivity.

The current study extends the findings from Medeiros and Cress (2016). We found that SGD use promoted but did not hinder parental responsivity and the parent-child interaction. As well, we also found that parental responsivity was significantly impacted by time (i.e. pre- to post-intervention) but we found no group differences. Moreover, we also found no significant difference among the directiveness across the intervention groups. Broberg et al. (2012) found that parent facilitation and modeling of communication *and* AAC is as important as responsive behaviors to encourage language in children with severe disabilities. As well, they found that parents who participated in their parental responsivity education program, ComAlong, showed a significant increase in their RAACS scores while the scores of those who did not participate remained unchanged. This also highlights the beneficial importance, as does our present study, of the inclusion of parental responsivity *and* AAC intervention together to perhaps most effectively impact child language development.

According to an extensive extant literature, only recently has there been a dynamic shift where parents are now more included and hands-on in the intervention process than ever before

(Kaiser et al., 2016). Therefore, this study provides information about the importance of assessing and ensuring effective communication strategies on the caregivers' part and not only the child's (Binger, Kent-Walsh, Berens, Del Campo, & Rivera, 2008; Kent-Walsh & McNaughton, 2005); this is especially true in the realm of AAC intervention (Sigafoos et al., 2003). Finally, the study also suggests that there is a relationship between contingent parental responsiveness and communicative outcomes in young children with developmental delay and few spoken words. That is, interventions should focus on parental strategies that increase contingent parental responsiveness and decrease directive behaviors, which may have positive impacts on child communicative outcomes.

In conclusion, the study found that there is a relationship between parental responsiveness and functional vocabulary outcomes. Moreover, the results suggest that parent-coached interventions involving AAC use promoted *and* did not hinder parental responsiveness. The findings of this study highlighted the importance of including families in the intervention process and showcased the role of parents as important social partners. This is especially important considering the primary component of the Ronski et al. (2010) study was teaching parents to effectively use AAC to communicate with their children. There was no direct intention by the researchers to measure or target parental responsiveness; thus, we can assume that the type of communicative interaction fostered across interventions generally promoted parental responsiveness.

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## APPENDICES

### Appendix A

*Comparison of Intervention Target Vocabulary, Mode, Strategies, and Parent Coaching.*  
From Ronski et al. (2010)

Component	AC-I	AC-O	SC
Target Vocabulary	Individualized target vocabulary of visual-graphic symbols + spoken words	Individualized target vocabulary of visual-graphic symbols + spoken words	Individualized target vocabulary of spoken words
Mode	I/P provides communication input to child with SGD	Child uses SGD to communicate	I/P and child use speech to communicate
Strategies	I/P provides vocabulary models to child using the device; symbols are positioned in the environment to mark referents	I/P encourages and prompts the child to produce communication using the device	I/P encourages and prompts the child to produce spoken words
Parent Coaching	I provides coaching and resource for P	I provides coaching and resource for P	I provides coaching and resource for P

*Note.* AC-I: Augmented Communication- Input; AC-O: Augmented Communication- Output; SC: Spoken Communication; I: Interventionist; P: Parent; I/P: Interventionist or Parent; SGD: Speech-Generating Device.

## Appendix B

### *Comparisons of Maternal Behavior Rating Methods*

Measure	Definition	Mode of Collection	Actual Behavior Coded	How Much Coded
Event-Based coding	Assesses all utterances made by an individual	Videotaped observation file	All maternal behaviors and communication aimed toward the child	All utterances except rapid succession, then only last utterance coded
Maternal Behavior Rating Scale (MBRS)	Assesses quality of maternal interactive behavior with young children	Videotaped observation	Expressiveness; Enjoyment; Warmth; Sensitivity to Child Interest & State; Responsivity; Achievement Orientation; Inventiveness; Appropriate, Physical, & Social Stimulation; Playfulness; Degree of Comfort; Effectiveness; Approval; Permissiveness; Patience; Directiveness	Global rating of each 18-item domain using 5-point Likert scale (0-5)
Responsive Augmentative and Alternative Communication Style Scale (RAACS) Version 3	Assess the communicative style of parents' with children with communication difficulties	Videotaped Observation File	Observable communicative behaviors	Score using 3-point scale for every behavior, minute-by-minute for items 1-7 (0-2); global score for items 8 & 9 (1-3); Overall RAACS Score

## Appendix C

### Summary of Coding Scheme for Maternal Behavior

Adapted from Warren et al., 2010

Code	Definition	Examples
<b>Level of Attention</b>		
Introduce (I)	Presents herself/new object or activity when child is not actively attending	Child gazing into space & talks about object in room; “what are you doing?”
Maintain (M)	References toy, behavior, etc. & keeps child’s active focus	Child standing, mom- “Look at you standing”
Redirect (R)	References new object when child is attentive to another	Child playing, mom- “what else do you want to play?”
Reading (E)	Reading verbatim w/o comments, description, etc.	Mom reading words off the pages of a book
<b>Function of Behavior by Mode</b>		
Request Behavioral Compliance (Spoken, Augmented, or Both)	May be directive, look/see statements, comment with gesture	S: “Sit down” A: “Point to __” with SGD B: “Show me __; say it” spoken & SGD
Request Verbal Reply (Spoken, Augmented, or Both)	Pauses, begins convo, directives, repeats word/phrase, verbal prompts	S: “Say __” A: “Tell me __” with SGD B: “Say __” spoken & SGD
Comment (Spoken, Augmented, or Both)	Makes a comment; praise or reaction to child; look/see statements for attention	S: “That’s bumpy”; A: “That’s __” with SGD B: “It’s __” spoken & SGD
<b>Supplemental</b>		
Recode (D)	Reproduces content word; expands/maps child’s intent/utterance	Child- “da”, mom- “daddy”; Child points, mom- “Oh you want...”
Communication Breakdown (Cb)	Seeks clarification of previous communication; inattentive to communication	“You want the doll?”; Child says “look” and no response (may repeat then parent seeks clarification)
Gesture (G)	Positive or negative idea transmission other than spoken communication	Sign, head nodding, pointing, etc.: “Mom waves while saying hi”

Zap (Z)	Limits, restricts, or disciplines behavior; not always negative	“Be careful/ watch it/ don’t do that/ wait/ shhh/ no/ stop”
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