The Effects of a Virtual Parent Training Program and Parental Stress on the Quality and Quantity of Parent-Child Interactions for Children with ASD

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Abstract

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A child's early language environment, and their parents' active engagement during parent-child interactions play a vital role in facilitating the development of complex social reinforcers and the growth of their verbal behavior. Using a verbal behavioral approach, this study aimed to measure the statistical significance of changes in the quality and quantity of parent-child interactions after parents participated in a virtual parent-training program. The intervention used was the Incredible Years-ASLD® (Webster-Stratton, 2015) program, which consisted of 12 group parent-training sessions delivered virtually in small groups. The study also aimed to assess the association between parental stress and the quality and quantity of parent-child interactions. Participants were seventeen biological mother-child dyads. The participant children attended a full-day, intensive Applied Behavior Analysis (ABA) preschool, with a mean age of 4 years and 3 months and either had an Individual Education Program for a preschooler with a disability or an Individualized Family Service Plan. The number of verbal operants exchanged between the mother and the child during the parent-child interactions were measured at baseline, during, and after the intervention. Parent-child interactions were designed to mirror their naturalistic interactions and consisted of a five-min structured-play task, and a five-min free-play task, which were recorded for future analysis. Self-reported parental-stress levels were

measured at baseline and after the intervention using the Parenting-Stress Index-Fourth Edition, Short Form (Abidin, 2012).

This pilot study was conducted to statistically evaluate the changes across all three conditions following the IY-ASLD® intervention on a) the *quantity* of mother-child interactions, as measured by the number of vocal-verbal operants initiated by the mothers (i.e., mands and tacts), and the number of approvals vs. disapprovals; and b) on the *quality* of mother-child interactions as measured by mothers' verbal responsiveness to their children's initiations, mothers' effectiveness in eliciting a response from their children, and the number of missed opportunities for mothers and children. The results for the first research question demonstrated that there was a statistically significant increase in the number of tacts emitted by the mothers in the free-play task, as well as a statistically significant decrease in the number of approvals following the intervention. There were no statistically significant changes in the number of mothers' mands or disapprovals. The results for the second research question demonstrated that, following the intervention, there was a statistically significant decrease in the number of missed opportunities for the children during the structured-play task, and in the number of missed opportunities for the mothers in both tasks. There was also a statistically significant decrease in children's responses to mothers' initiations in the free-play task.

This study also aimed to assess the relation between parental stress and the quality and quantity of parent-child interactions. The findings suggested a statistically significant negative association during the pre-intervention condition between parental-stress and the quality of parent-child interactions, specifically, mothers' responsiveness to their children's initiations. Furthermore, mothers' stress levels were significantly negatively associated with the number of

mands emitted by the mothers, but not associated with the quantity of the other vocal-verbal operants.

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Dedication

To my beloved parents, Baba Saud Alshowaiman and Mama Fatma Alshohaib, this manuscript and my doctoral degree would not have been possible without your unwavering love and support. Throughout my academic journey, you have been by my side (mostly through FaceTime), providing me with endless love and encouragement. Your belief in me since I was a child have been the driving force behind my academic journey. This manuscript serves as a testament to the profound impact you have had on my life and a reflection of the incredible parents you are. Your selflessness and tireless efforts have shaped me into the person I am today. I am profoundly aware of the countless sacrifices you have made for me. You have always put my needs before your own, allowing me to pursue my dreams and reach for excellence.

Baba and Mama, with deepest appreciation and infinite love, I dedicate this manuscript to you both. Thank you for being my guiding lights and constant source of strength. This dedication is a heartfelt tribute to your remarkable influence in my life. I am deeply grateful for everything you have done.

With all my heart,

Lenah.

Introduction

An environment rich in language and social interactions is one of the most critical factors in facilitating optimal early language acquisition. Adult caregivers who provide an environment rich in verbal behavior and social interactions are a vital component for incidental language acquisition through the conditioning of observing responses (e.g., observing adults' faces and voices) as reinforcement, which in turn, leads to the joining of observation and production responses (Greer & Ross, 2008; Greer & Du, 2015; Keohane et al., 2009; Maffei-Lewis et al., 2014). A study by Rowe (2008), found that a child's verbal behavior development was positively associated with both the quantity and quality of child-directed speech (CDS) that they received from their parents. Specifically, the study found that parents who used a greater quantity and higher quality of CDS had children with better verbal behavior skills, suggesting that the amount and type of language input that young children receive from caregivers play an important role in their subsequent verbal development.

The following review of the literature will first begin by briefly identifying three of the most common theories of language development. It will then focus on the origin and theory of verbal behavior as proposed by Skinner (1957) who provided evidence on the role that a child's early language environment plays in his or her verbal development. In the subsequent section of the literature review, the critical role that two environmental factors, quantity and quality of adult's language input, bear on the child's verbal development will be discussed, and a list of determinants that might affect the quality of parenting as proposed by Belsky's (1984) theoretical framework. This includes (a) child characteristics (i.e., an autism diagnosis), (b)

contextual factors (i.e., resource constraints and accessibility), and (c) parent characteristics (i.e., parental stress). The literature review will also examine the effects of stress on the quality of parent-child interactions by exploring Patterson's (1990) coercive parenting model, Abidin's (1990, 1992) model of parenting, which focuses specifically on the role of parenting stress in shaping parent-child interactions and its impact on children, and the transactional model of stress and coping (Lazarus & Folkman, 1984).

After reviewing the literature on verbal development and understanding the importance of a child's early verbal environment, the focus of this review will turn to examining the evidence that support the active engagement of parents in their child's educational and behavioral management through parent training. Some of the well-known evidence-based parent training programs will also be reviewed briefly, while the Incredible Years-ASLD® will be discussed thoroughly. Next, the review will discuss the characteristics of effective parent training programs and the different delivery methods of parent training programs, including individual, group, and virtual formats. Lastly, the review will elaborate on the utilization and benefits of the virtual format in the educational field.

Chapter 1: Review of the Literature

Theories of Language Development

Language is one of the most critical developmental aspects for an individual to succeed in society (Ehrman & Oxford, 1995). Scientists have long focused on measuring human development, behavior, and language while attempting to pinpoint the factors that affect a child's verbal development and explaining them through a cognitive, social, or behavioral approaches. Linguistic theories can be broadly categorized into three general, and often overlapping, views: biological theory, cognitive theory, and environmental theory. Biological theorists believe that language has little to do with environmental variables, such as reinforcement and stimulus control; rather it is innate to humans and primarily the result of physiological processes and functions (e.g., Chomsky, 1965; Pinker, 1994). Chomsky proposed that the basic structures of language are already encoded in the human brain at birth via a Language Acquisition Device (LAD) consisting of a system of principles that helps them learn language and accounts for the order in which children learn structures, and the mistakes they make as they learn later. He later developed the concept of Universal Grammar (UG), an innate mental set of fixed principles and flexible parameters that clarify what is common to all human languages. Cognitive theorists believe that language is controlled by internal cognitive processing systems that accept, classify, code, encode, and store verbal information. (e.g., Brown, 1973; Piaget, 1926; Slobin, 1973). The cognitive theory of language development theorizes that language acquisition is primarily the result of attention, memory, and problem-solving, and that children actively construct knowledge about language through their experiences with it (Vygotsky, 1978; Tomasello, 2003).

Environmental theorists or Radical Behaviorists such as Skinner, who was very critical of linguistics, believed that the role of the environment is the main key to human language acquisition, as they view language as a learned behavior under the functional control of environmental contingencies. Therefore, Skinner wanted to present his explanation of verbal behavior as an alternative that would be "appropriate to all special fields" (1957a, p. 4).

Despite their differences, these theories share some major similarities. For example, all three theories acknowledge the importance of early experiences in shaping language development. The cognitive theory and the environmental theory emphasize the role of social interaction, while the biological theory suggests that genetic factors may influence a child's ability to learn language. All three theories agree that the rate of learning depends on the child's developmental level. In addition, many researchers now view language acquisition as a complex interplay between biological and environmental factors, which is consistent with all three theories. For example, researchers have found that the genetic makeup of an individual can influence the way they acquire and use language, but that environmental factors such as language exposure and social interaction are also critical in shaping language development (Tomasello, 2003).

While Skinner's Verbal Behavior is based on theoretical underpinnings, his contribution inductively led to the development of a substantial body of research with empirical evidence that supports his theory (Greer & Keohane, 2005). The work of Skinner paved the way for the establishment of verbal behavior as a science. His theories have been extensively employed in the field in the development of several interventions that are tailored for children with disabilities. The current study focused on the behavioral perspective on verbal development, for

its relevance in how it specifically investigates the child's environment and the role that the parent plays in parent-child interactions.

Skinner's Verbal Behavior

B.F. Skinner, the chief radical behaviorist, conceptualized and proposed the theory of verbal behavior, which became of interest in the fields of basic and applied sciences of behavior analysis. In his 1957 book, *Verbal behavior*, arguably his most influential work, he emphasized the impact of the environment on verbal behavior development. Skinner's book was, at that time, the most ambitious of the behavioral theories, as it aimed to explain human communication from a behavioral perspective unlike his contemporaries who saw language as a product of an internal mechanism, an instinct, or a result of the 'mind.' Moreover, Skinner defined verbal behavior as the process in which all the mediation and production functions of language responses relate to the environment or, "…behavior reinforced through the mediation of other persons' needs…" (p. 2). Therefore, Skinner explains that the behavior of the speaker is under the stimulus control of the listener, who is conditioned to precisely affect the behavior of the speaker through environmental contingencies. Skinner later refined his evolving definition of verbal behavior to include that the role of the speaker's verbal behavior is to affect his or her environment, and be mediated by others (i.e., the listener) whose behaviors have been shaped and maintained by the verbal community or the environment (Skinner, 1987).

Unlike the previously mentioned linguistic theories that focused on the topography of language, Skinner examined a general theory of communicative behaviors that also incorporated language. In his book, he referred to "language" as merely a part of an individual's

communicative behaviors, or verbal behavior. Skinner made a clear distinction between verbal and vocal behaviors, as verbal encompasses all forms that could be used by an individual to interact with an audience, and not only in the speaking topography. He included gestures, such as sign language, Morse code, and even smoke signals in his definition of verbal behavior, as they are all communicative behaviors that have an effect on the audience (1957). Skinner and other radical behaviorists differentiated between the structure and the function of verbal behavior. Linguists study the structure of language, and although it is important to understand the role of structure in verbal behavior, Skinner and colleagues sought to study the function of verbal behavior, which reveals information on the role of the environment in verbal behavior.

In Skinner's 1957 book, *Verbal Behavior*, he outlined, for the first time, the different verbal operants that humans emit and why they use language in the ways that they do from a behavior analytic perspective. He discussed all the forms of verbal behavior that we know humans engage in, encompassing listening, speaking, reading, and writing. However, although his work includes discussion surrounding the relevant establishing operations that occasion the onset of various verbal operants, he does not provide an in-depth analysis of how humans get to the point of being "truly verbal;" (i.e., when an individual simultaneously behaves as a speaker and as a listener) (Barnes-Holmes et al., 2001; Greer & Ross, 2008; Horne & Lowe, 1996), nor does Skinner provide solutions if certain repertoires were missing.

Verbal Behavior Development Theory

The need for a theory that explained verbal development all the way through an individual's ontogenetic lifespan until that individual becomes "truly verbal" have led to the

development of the Verbal Behavior Development Theory (VBDT) (Greer & Ross, 2008; Greer & Speckman, 2009). Greer's verbal behavior development theory is an empirical account of Skinner's verbal behavior that seeks to explain the stimulus control and ontogenetic sources of hypothetical constructs acknowledged in cognitive and developmental psychologies (Greer, 2008). VBDT explains the attainment of the foundational cusps such as observing responses, incidental learning, and conditioned reinforcement through the study of the environmental controls that result in the establishment of verbal behavior repertoires. VBDT focuses on identifying the multiple sources of incidental language acquisition and developing the necessary scientific protocols and tactics derived from the principles of behavior to induce any missing verbal behavior (Greer & Ross, 2008). In their study of behavior development, Rosales-Ruiz and Baer (1996; 1997) established the concept of cusps. They defined a behavioral cusp as a behavior change that permits an individual to come in contact with new contingencies and opportunities to learn (Rosales-Ruiz & Baer, 1997). According to Dinsmoor (1983), observation itself is an operant response, and is controlled by conditioned reinforcers for those observing responses. When an individual observes, he or she contacts a stimulus via one or more senses. For instance, it has been argued that once a child acquires conditioned reinforcement for observing responses, discrimination progresses more rapidly (Dinsmoor, 1983; Pereira-Delgado et al., 2008; Tsai & Greer, 2006) and eventually higher-order developmental capabilities such as Naming can emerge (Longano & Greer, 2014).

The body of work developed by the researchers of the VBDT within the Comprehensive Application of Behavior Analysis to Schooling (CABAS®) model, have contributed to the field and conceptual phenomena related to verbal behavior development (Greer, 2008; Greer &

Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009; Singer-Dudek, et al., 2010). Greer and his colleagues in the CABAS® model studied the presence of environmental controls related with the trajectory of verbal behavior development. Their research on the foundational cusps lends support to Dinsmoor, as many of those cusps are the acquisition of observing responses as conditioned reinforcers (Greer & Du, 2015). In addition to identifying related learning cusps, VBDT proposed the importance of studying the verbal behavior development trajectory. Within the verbal behavior development trajectory, individuals acquire cusps that lead to the extension of their environments through verbal exchanges (Greer, 2008; Greer & Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009). Without the development of specific verbal cusps, the attainment of one operant would not lead to the attainment of new operants; specifically, all operants must be taught independently with no one operant resulting in the acquisition of new ones (Rosales-Ruiz & Baer, 1997). Lastly, with understanding of the trajectory, behaviorists and linguists can pinpoint the missing cusps, develop the appropriate interventions needed to induce these cusps, and most importantly, determine the specific environmental experiences that result in the attainment of these cusps (Greer, 2008).

The Effects of Early Language Environments on Verbal Development

The identification of environmental contingencies and experiences that facilitate verbal development support Skinner's theory of Verbal Behavior. As mentioned previously, other approaches to language development have been more structural in nature and suggest that humans are born with a unique mechanism that enables the production of functional language (i.e., Chomsky). However, previous, and current research suggests that although verbal behavior

is unique to humans it is developed through cultural selection and environmental experiences (Greer & Keohane, 2005). These findings suggest that while humans may have the capacity to learn and process verbal behavior, the environment plays a significant role in promoting verbal behavior development. Greer and Du (2015) argue that the source of these verbal behavioral developmental cusps is conditioned reinforcement for observing responses; conditioned reinforcers establish conditioned motivating operations for verbal behavior. Therefore, the acquisition of social conditioned reinforcers is the key to verbal behavior development. Evidence of the role that a child's early language environment plays in his or her language development has been mounting for several decades. Numerus studies showed that early language exposure significantly correlated with a child's developmental trajectory, including their future cognitive and educational achievements (Fernald et al., 2013; Gallaway & Richards 1994; Gilkerson et al., 2017; Huttenlocher et al. 2010; Rowe, 2008; Rowe, 2012; Weisleder & Fernald, 2013).

Rowe (2008) investigated the relationships between the quantity and quality of child-directed speech (CDS) and child vocabulary skills to identify factors that may influence language development in young children, such as socioeconomic status (SES). The participants were 47 mothers and their children (ages 2 to 6) from diverse socioeconomic backgrounds. Child-directed speech (CDS) was defined as the language input that mothers directed specifically to their child during a 90-minute free-play session. This included both vocal and nonvocal communication, such as talking, singing, and gesturing. CDS is characterized by features such as simplified vocabulary, exaggerated intonation, and slower speech rate. The study used the Peabody Picture Vocabulary Test (PPVT-III), a widely used standardized measure in research on language development, to assess the child's comprehension (i.e., listener skills). This test assesses listener

skills by presenting the child with a series of pictures and asking them to select the picture that matches a spoken word. To assess the quantity and quality of the interactions, Rowe analyzed the parent's CDC measures, which involved transcribing the 90-minute sample, coding and analyzing the language used by the mothers during the interaction. The transcriptions were analyzed for several features of language, such as the number of words, the number of different words (vocabulary diversity), and the complexity of the sentences. Rowe also categorized the social pragmatic (i.e., the function) of the CDC, with some coded as eliciting speech from the child (i.e., mands for information), such as asking them *wh*-questions, or directive (i.e., mands), such as asking them to "put the doll on top of the car."

Rowe (2008) found that there was a positive association between the quantity and quality of CDS provided by the mothers and the child's listener skills. Specifically, the study found that the overall quantity of CDS (measured by the number of words) and the quality of CDS (measured by the complexity of sentences) were positively associated with the child's listener skills. The study also found that there was a significant difference in the quantity and quality of CDS provided by mothers from different socioeconomic backgrounds. Mothers from higher SES backgrounds provided more overall CDS and higher quality CDS compared to mothers from lower SES backgrounds, however, this relation was mediated by the parent's knowledge of child development. This study highlights the importance of addressing the disparities in language input that some children may face, as this may have a significant impact on their verbal behavior development and future academic success. It also highlights the importance of parent training and education to mediate the effects of adverse situations.

Several researchers examined the associations between a child's verbal development and their environment, including the affective-relational environment (e.g., parental sensitivity), as well as the language environment (e.g., quality and quantity) (Anderson et al., 2021). However, while the quantity of parental input has been consistently defined (Rowe, 2012), the quality of parent-child interaction has been conceptualized in various ways and operationalized by multiple measures (Bohr, et al., 2018). Studies measuring the qualitative aspects of parent-child interactions usually focus on interrelated dimensions that include the parent's behaviors, the child's behaviors, and the dyadic interaction itself (Tomasello et al., 1986; Tomasello & Todd, 1983). Rowe and Snow (2020) suggested that the quality of verbal interactions can be analyzed along three dimensions: interactive features (e.g., responsiveness, joint attention, conversational units, sequelics), linguistic features (e.g., lexical diversity and grammatical complexity), and conceptual features (e.g., contextualized and decontextualized features). In the following sections, this paper will discuss the role that that a *qualitatively* and *quantitively* rich early language environment bear on the child's verbal behavior development, as well as discussing a list of determinants that might affect parenting.

Quantity of Parent-Child Interactions

Numerous studies have found a relation between the quantity of adult language directed to children and their subsequent verbal behavior development. The widely cited 1995 longitudinal study by Hart and Risley demonstrated a significant correlation between the amount of language input young children are exposed to, that were collected from seven to 36 months of age, and their future verbal and cognitive development. In another study by Rowe (2012), she

investigated the role of parent-child interactions on vocabulary (i.e., speaker skills) development in preschool-aged children. The researchers recorded parent-child interactions in the home and analyzed the quantity and quality of adult language input that children received. They then assessed the children's speaker skills using standardized measures a year later. The study found that children who experienced more frequent and engaging conversations with their parents had larger vocabularies than children who did not. This suggests that the quality and quantity of parent-child interactions have a significant impact on the development of speaker skills in young children.

Fernald et al. (2013) investigated the relationship between early language exposure and language processing (i.e., listener skills) efficiency in infancy. The researchers measured the language input that 18-month-old children had received during their first year of life using a standardized measure of parent-child interactions. They then measured the children's listener skills using a computerized measure that assessed how quickly the children could identify words in a list. The study found that infants who had received more language input during their first year of life had higher language processing efficiency at 18 months of age. This suggests that early language exposure has a positive impact on the development of listener skills, which is crucial for later verbal behavior and cognitive development. Another study conducted by Weisleder and Fernald (2013) using naturalistic recordings in the homes of 29 infants found that the amount of speech addressed to the child at the age of 19 months were associated with vocabulary growth by the age of 24 months.

Gilkerson et al., (2017) utilized recent innovations in audio recording and automated voice labeling through the Language ENvironment Analysis (LENA) System that allowed for the

efficient collection and analysis of large amounts of naturalistic language samples. Neurotypically developing children between the ages of two months to 48 months completed monthly recordings in their natural environments for 12 hours for a period of 6-38 months. The study found that children's language exposure predicted their vocabulary and grammar development, and that parents who provided a high quantity of words and engaged reciprocal conversations had children with higher language scores. This suggests that real-time measures of language exposure can provide valuable information about the quality and quantity of language input that children receive and can help identify interventions to support language development.

Based on the evidence that the quantities of complex language exposure support early verbal behavior development (e.g., Rowe, 2012; Tamis-LeMonda, et al., 2012; Weisleder, & Fernald, 2013), several state and city-level programs have been developed. These programs mostly focus on enhancing early language environments for young children by increasing the quantities of words and concepts that children are exposed to (e.g., Leffel & Suskind, 2013; Suskind et al., 2013). However, these broad intervention programs fail to take into consideration the vital role of the *quality* of parent-child interactions.

Quality of Parent-Child Interactions

In addition to the significance of an environment with a high *quantity* of language exposure, there is evidence to support that exposure to high *quality* adult language significantly enhances a child's verbal behavior development (Gilkerson et al., 2017; Liu et al., 2003; Rowe, 2008; Rowe, 2012). Specifically, the role of caregivers' responsiveness and sensitivity to children's interests, attention, and cues, the diversity and sophistication of vocabulary used, and

the clarity of adult speech patterns (Siller & Sigman, 2002, 2008). Most of this natural curriculum (i.e., parent-child interactions) is specifically tailored and fine-tuned by the parents to meet their children at their developmental levels (Baumwell et al., 1997; Bornstein et al., 1999; Bruner, 1981; Chapman, 2000; Sokolov 1993). The literature linking the qualitative aspects of parent-child interactions with the child's ultimate educational outcomes is equally compelling (Ruble et al., 2008). Generally speaking, the massive number of words and sentences children are exposed to are not undifferentiated noise; most adults naturally utilize a range of language-related teaching styles, including adjusting the complexity of their speech, scaffolding, contingent imitation of their children, using a slower rate of articulation, and a higher pitch and exaggerated intonations, as well as modeling (Warren et al., 2010).

The terms parental *sensitivity* or parental *responsiveness* have been widely used in the field as a measure of the quality of parent-child interactions, and their significance is based on studies that have linked them to specific aspects of child verbal development (e.g., Hirsh-Pasek & Burchinal, 2006; Nozadi et al., 2013; Paavola et al., 2006; Vallotton et al., 2017). *Parental responsiveness* refers to the extent to which a parent promptly attends to and responds to their child's verbal behavior (Belsky, 1984; Rowe, 2020; Siller & Sigman, 2002, 2008; Smith, 2006). This can involve responding to the child's vocal and non-vocal verbal responses, such as when they cry, fuss, or reach out for a hug or attention (Bornstein, 2002). Responsive parenting is also characterized by contingent positive reinforcement of desired behaviors (Ruble, et al. 2008). *Parental sensitivity,* on the other hand, involves a parent's ability to accurately identify and respond to their child's non-vocal verbal behaviors, or their "cues and signals," such as their facial expressions, body language, and tone of voice, and responding in a way that is supportive

and validating (Lieberman et al., 1991; Spinrad et al., 2006). Sensitive parenting is also characterized by flexibility and responsiveness to the child's changing needs and developmental stage, and adjusting one's parenting style accordingly (Bornstein, 2002). While both responsiveness and sensitivity involve being quick at meeting the child's needs, responsiveness is more focused on the behaviorally measurable and observable aspects of meeting those needs, while sensitivity is more focused on the emotional aspects of the parent-child relationship (Bornstein, 2002). Madigan et al. (2019) conducted a recent meta-analysis to assess the associations between maternal sensitivity/maternal warmth and child verbal behavior development, results of their review showed a moderate association.

Bornstein et al. (1999) followed infants from 9 months to 2 years of age and examined the relationship between their vocabulary (i.e., verbal behavior) development and their parents' verbal responsiveness. The study included both laboratory assessments and naturalistic observations of parent-child interactions. Verbal responsiveness was measured as the frequency and quality of parents' responses to their infants' verbal behaviors. Verbal behavior was assessed using the MacArthur Communicative Development Inventory (CDI), a standardized test that measured the number of words infants accurately respond to and produce. The study found that infants' vocabulary size at 14 months was significantly correlated with their parents' verbal responsiveness at 9 months, indicating that early parental responsiveness predicted later vocabulary development.

Tamis-LeMonda et al.'s (2001) study examined the relationship between maternal responsiveness and children's achievement of language milestones (i.e., levels of verbal behavior) during the first two years of life. The researchers followed a group of infants from

diverse socioeconomic backgrounds and assessed their language development at six-month intervals. Maternal responsiveness was measured as the frequency and quality of mothers' vocal and non-vocal responses to their infants' verbal behaviors, including vocalizations, gestures, and facial expressions. The researchers also assessed mothers' sensitivity to their infants' cues, as well as their use of language stimulation strategies such as labeling, expanding on infants' utterances, and asking questions. Children's verbal behavior development was assessed using a standardized test that measured their accuracy in listener and speaker tasks. The researchers also tracked the age at which children achieved key levels of verbal behavior, such as first words and first word combinations. The study found that maternal responsiveness in the first year of life was a strong predictor of children's verbal development in the second year, even after controlling for children's earlier verbal behavior skills. Specifically, infants who had more responsive mothers had larger speaker repertoires, achieved higher levels of verbal behavior earlier, and showed more advanced syntactic development.

Determinants of the Quality of Parent-Child interactions

Several factors affect the establishment and the maintenance of quality parent-child interactions. Belsky's theoretical framework on the determinants of the quality of parenting has been a widely used reference in research on parenting and child development (Belsky, 1984; Bornstein, 2002). The model highlights the importance of considering multiple factors when examining the parent-child relationship including, child characteristics, parent characteristics, and contextual factors. By understanding the interplay between these factors, researchers and

practitioners can develop interventions that target the specific needs of parents and children in different contexts and promote positive outcomes for children's development.

The following review of the determinants of parenting will further explain Belsky's theory while focusing on one factor for each, that are relevant to the current study: a) child characteristics, specifically autism spectrum disorder; b) parent characteristics, such as parental stress; and c) contextual factors, such as resource constraints and accessibility (Belsky & Isabella, 1988; Engle & Ricciuti, 1995; Rutter, 1979).

Child Characteristics. According to Belsky (1984), child characteristics are a key factor in determining the quality of the parent-child interaction. Belsky argues that children have unique characteristics that can impact the quality of parent-child interaction, including the child's temperament, age, gender, and developmental stage. For example, research has shown that children with difficult behavioral problems may elicit fewer positive responses from their parents, leading to fewer positive parent-child interactions (Aksan & Kochanska, 2004; Belsky & Pluess, 2009). Similarly, children who are in a later developmental stage may require different parenting strategies than younger children, as they may have different needs and strengths (Bornstein, 2002).

Disparities in the early language environments have been recorded in children with intellectual or developmental disabilities; adult-child interactions with this population occur less frequently than with neurotypical children (Warren et al., 2010). This is especially true for children with autism spectrum disorder. Autism spectrum disorder (ASD) is a neuro-developmental disorder that affects verbal behaviors, social-verbal interactions, and behaviors. It is a spectrum disorder, meaning that it affects individuals differently and to varying degrees.

According to the *Diagnostic and Statistical Manual of Mental Disorders*, 5th edition (DSM-5), autism is characterized by persistent difficulties in social communication and interaction, and restricted, repetitive patterns of behavior, interests, or activities. These difficulties are evident in early childhood and impact daily functioning. According to the Centers for Disease Control and Prevention (CDC), in 2020, an estimated 1 in 54 children in the United States have been diagnosed with ASD. This estimate is based on data collected from the Autism and Developmental Disabilities Monitoring (ADDM) Network. (CDC, 2020). The social and communication impairments with this population are often present within the first 18 months. Parents of children with autism often report delayed or disrupted onset of babbling, poor responsiveness to the initiations of others, or the lack of initiation and/or maintenance of joint attention (Kasari et al., 2013; Paul et al., 2011; Werner et al., 2005; Wetherby & Prizant, 2002). Recent research has also emphasized the importance of early identification and intervention for children with autism. For example, a study by the CDC (2020) found that early behavioral intervention can greatly improve outcomes for children with autism.

Such difficulties usually affect the parent-child interactions, resulting in a decrease in language input at a time when language exposure is vital to verbal development (Beckerman et al., 2018). Kaiser et al. (2010) conducted a study to investigate the effects of parent-implemented language interventions on spontaneous language in young children with autism. They found that parents of children with autism used fewer words, had fewer conversations, and engaged in less responsive responses with their children compared to parents of typically developing children. Another study by Wan et al. (2013) examined parent-infant interaction in infant siblings at risk of autism. The study found that parents of children with autism used fewer gestures and showed

less responsiveness to their children's communicative attempts compared to parents of typically developing children. The study also found that the quality of parent-infant interaction predicted the children's later autism symptoms and cognitive abilities. Furthermore, Kasari et al. (2013) conducted a study to assess the language environments of non-vocal school-aged children with ASD. The study found that their parents used more controlling language (e.g., mands and corrections) and fewer approvals compared to parents of typically developing children. McDuffie et al. (2005) investigated predictors of verbal development in children with ASD and found that parents of children with ASD used fewer linguistic acts (e.g., tacts, commenting, questioning) compared to parents of typically developing children. The study also found that joint attention, gesture use, and social orienting predicted verbal behavior outcomes in children with ASD.

Warren et al., (2010), used an automated vocal analysis device named Language ENvironment Analysis (LENA) to compare the vocal production and language learning environments of 26 children with autism to a matched sample of 78 neurotypical children, ranging in age from 16 to 48 months. Data were collected during 12-hr recording sessions in each child's natural environment and the continuous digital audio recording was later processed by a computer software and sorted into discrete segments that were further processed into an estimate of adult and child vocal responses count (frequency and duration) and conversational turns between the child and the adult. Results of the study showed no statistical differences between the adult word counts. However, the difference in conversational turns and child vocal responses were statistically significant as children with autism engaged in 26% fewer conversational turns than their neurotypical peers. Furthermore, the lengths of the conversational turns that children with ASD engaged in were significantly shorter than those of the neurotypical

children, and children with ASD were more likely to have vocalizations that were not responded to by adults.

Parent Characteristics. Belsky also suggested that the quality of parent-child interaction is influenced by the characteristics of the parent. These characteristics include the parent's personality, their parenting style, and their level of stress. Other characteristics that have been shown to influence parent-child relationships include age, educational background, and their mental health (Hays & Watson, 2013; Engle & Ricciuti, 1995; Lyons-Ruth et al., 1984). For example, parents who have high levels of stress, depression, or anxiety may struggle to provide a high-quality language environment for their children (Belsky, 1984; Crnic & Low, 2002). Parenting a child is a challenging but rewarding experience that involves a wide range of emotions, including joy, triumph, uncertainty, exhaustion, and stress (Lareau, 2011; Miller, 2018). Parents deal with an overwhelming amount of stress to meet their children's needs. While raising a child is stressful for all parents, the burden of those responsibilities is amplified for parents of children with disabilities. Specifically, researchers have shown that parents of children with ASD are significantly more stressed than not only parents of neurotypical children, but also parents of children with other developmental disabilities (Faria et al. ,2020; Eisenhower et al., 2005; Hayes & Watson, 2013). Several researchers have found that parents of children with ASD were the most adversely affected by unique stressors associated with raising a child with a disability. Families of children with ASD who require medical diagnosis, early intervention, parent education, special education, healthcare, and related services face a challenge in navigating disconnected service systems. These systems have their own entry points, waiting

lists, and criteria for service delivery, which can create a complex and disjointed experience for parents (Bultas et al., 2015).

When comparing them with parents of children with other disabilities such as Downs syndrome (Dabrowska & Pisula, 2010; Griffith et al., 2010; Kasari & Sigman, 1997), cerebral palsy (Blacher & McIntyre, 2006), or Fragile X Syndrome (Abbeduto et al., 2004), parents of children with autism reported higher levels of stress. Hayes and Watson (2013) conducted a meta-analysis comparing the experience of parenting stress in parents of children with autism spectrum disorder to neurotypical children or those with other disabilities. Their analysis only included studies where the outcome measures had been designed to capture parental stress, and the majority of studies used established measures of parental stress, such as the Questionnaire on Resources and Stress (QRS; Holroyd, 1987) or the Parenting Stress Index (PSI; Abidin 1983). The results of their meta-analysis showed that parents of children with ASD reported significantly higher levels of parenting stress. The effect size calculated by the researchers indicated that the difference in parenting stress levels between parents of children with ASD and those of typically developing children or those with other disabilities was large. The findings of this study suggest that parents of children with ASD face unique stressors that are not experienced by the other parents. These stressors may include difficulties related to communication, behavior management, and access to services and support. Interventions that target these specific stressors may be helpful in reducing parenting stress in families with a child with ASD, and ultimately improving outcomes for the child and the family.

Children with ASD demand a higher level of support and require more time investment from their parents due to the specific challenges of their condition that causes their behavioral

issues and their limited language (Bonis & Sawin, 2016; Hastings & Johnson, 2001). The lifelong prognosis of ASD and their dependance on their parents is another stressor that these parents deal with (Anderson et al., 2007; Billstedt et al., 2011; Howlin & Moss, 2012; Magiati et al., 2014). Seltzer et al. (2001) conducted a longitudinal study on parents of children with developmental disabilities and found that more than 50% of parents aged 50 or older reported living with their child, which was significantly higher compared to the rate of 17% for parents of typically developing children. To measure the lifelong prognosis of ASD, Howlin et al., (2004) followed 68 individuals meeting the criteria for autism with a mean age of seven years (range 3-15 years) when they were first seen until mean age of 29 (range 21-48 years). Results of their standardized cognitive, language, social and behavioral tests showed that most of them, 58%, had "poor" to "very poor" outcomes. Overall, the group's communication, reading, and spelling skills were poor, and their stereotypical behaviors persisted into adulthood. Although some of the individuals had relatively high levels of independence (e.g., living alone or permanent employment), most of them remained completely dependent on their families for support in financial, education, and housing throughout their lives.

Contextual Factors. Belsky suggested that the quality of the parent-child interaction is influenced by the broader context in which the interaction takes place. This includes factors such as the family's socioeconomic status, the availability of resources and social support, and the cultural norms and values of the community. For example, a family living in poverty may face additional stressors that can impact the quality of the parent-child relationship (McLoyd, 1990). Due to the high prevalence of ASD and the lifelong nature of the condition, there's a significant demand for services to support these individuals across many aspects of their lives, from health

and education to social care. In comparison with other disabilities, individuals with ASD require higher rates of service utilization and costs (Zerbo et al., 2019). Furthermore, on indicators of life-quality, individuals with ASD have scored considerably lower than neurotypical individuals, as they were less likely to live independently of their families or find paid employment (Howlin et al., 2004). Unfortunately, it can be difficult for parents of children with autism to find appropriate services for their children. According to a study by the Autism Society of America (ASA), a significant number of parents reported difficulty in accessing services and supports for their children with autism, with some families waiting years for services (ASA, 2015). Another study found that there are various barriers to accessing services, including limited availability of services, lack of insurance coverage, and long waiting lists for services (Newman, et al., 2014). These barriers can lead to significant stress for families and can impact the development and quality of life for the child with autism.

Furthermore, despite the growing need for professionals who can work effectively with children with autism, there is a lack of proper training for many of these individuals. This shortage of trained professionals can result in inadequate support for children with autism and their families (Autism Society of America, 2015). In a national survey of parents of children with autism, a significant number reported that the lack of proper training for professionals was a barrier to accessing services and supports for their children (Autism Society of America, 2015). Moreover, research has shown that many professionals who work with individuals with autism lack the skills and knowledge necessary to effectively support their development and success (Newman et al., 2014). This highlights the need for increased training and professional

development opportunities for professionals who work with children with autism, so they can provide the best possible support and services to these individuals and their families.

The Effects of Parental Stress on Parent-Child Interactions

One of the most extensively studied domains concerning parents of children with Autism is the effect of parenting stress on parenting behaviors and childhood outcomes (Burrell & Borrego, 2012; de Veld et al., 2017; Shalev, 2019). Parental stress refers to a complex, aversive psychological process where the parent's wellbeing and behavior, the quality of the parent-child interactions, the child's psychosocial adjustment, and the parenting demands interact with one another to create the experience of negative feelings toward the self and child (Crnic & Greenberg, 1990; Deater-Deckard, 1998). Hayes and Watson (2013) defined parental stress as "the psychological distress and symptoms of anxiety and depression that parents may experience in response to the chronic stressors associated with raising a child with ASD" (p. 254). They also noted that parenting stress can have negative consequences for the mental health and well-being of parents, as well as the development and behavior of their children. As mentioned earlier and in several research papers, parents of individuals with ASD are a highly stressed group (Dykens et al., 2014; Frantz et al., 2018). Parental stress can be influenced by a variety of factors, including child characteristics, family dynamics, and access to support and resources (Deater-Deckard, 1998). For example, in samples of typically developing children, many of these factors have been shown to negatively affect parenting behaviors (Beckerman et al., 2018). Beckerman et al. (2018) conducted a study with 195 parents of typically developing children between the ages of 1.5 to 6 years old. The researchers used several self-report questionnaires to measure parental

stress and observed parent-child interactions in a standardized play task. The study found that parents with higher levels of stress, depression, and anxiety were less likely to display positive parenting behaviors such as responsiveness, and positive reinforcement, and they were more likely to use negative parenting strategies, such as criticism, threatening, yelling, and physical punishment. This suggests that parental mental health plays an important role in shaping parenting behaviors and has implications for child development. Furthermore, it is known that children's problematic behaviors can be reinforced by some parental behaviors (Hastings, 2002). In one study, the effects of an early intervention program for children with ASD were counteracted by the high levels of parental stress (Dempsey et al., 2009). Specifically, after undergoing a parent-mediated intervention, children whose parents reported higher levels of stress at baseline, did not show as much improvement in their communication and social skills as children whose parents reported lower levels of stress. Furthermore, Shalev et al. (2020) conducted a systematic review on the impact of baseline parent characteristics as moderators of their children's treatment outcomes in parent-mediated interventions for children with autism. They reviewed the literature for parent-mediated interventions that were published between 1987 and 2018 and identified 115 studies but only 11 of these studies met the inclusion criteria (i.e., the studies had to have examined the contributions of baseline parent/caregiver characteristics on children's outcomes). All studies employed group-based intervention models, and 90% of the studies included children under six years. The studies varied in regard to treatment strategies used, children's outcomes, and parental or familial characteristics examined. Results of their analysis indicated that several factors may be related to children's outcomes, including parental stress. The effects varied depending on the specific treatment and outcome examined.

Furthermore, some researchers also found that the quality of parent-child interactions decreases as parental stress increases (Kangas-Dick et al., in press), which led them to believe that there's a bidirectional influence between the child and the parent's behavior, which should be taken into account when assessing and intervening with parent-child relationships (Hastings, 2002; Patterson et al., 2004). According to Hastings (2002), understanding parent behaviors and the influences that they have is crucial in understanding behavior problems in children with developmental disabilities. The relationship between parents and children is reciprocal, where the behavior of children can cause stress in parents, and as a result of this stress, parents may adopt specific parenting behaviors that can unintentionally reinforce their child's problematic behavior (Hastings, 2002). Patterson (1990) developed a behavioral model for predicting parenting behavior. His model describes the relationship between coercive parenting behavior and child conduct problems, suggesting some of the determinants of antisocial and aggressive behavior in children. His model emphasizes the critical role that parents play in shaping their child's behavior and suggests that effective parenting requires a balance of structure and consistent reinforcement. Patterson's model for predicting parenting behavior is based on the idea that a child's behavior can be influenced by their environment and the interactions they have with their parents. This model suggests that parents who are consistently engaging with their children, and use positive reinforcement are more likely to have children who engage in more desirable behaviors, while parents who use harsh punishment or inconsistent discipline are more likely to have children who exhibit behavior problems. The model also highlights the importance of understanding the underlying reasons for a child's behavior and addressing those issues in a constructive and supportive manner. Oliver's (1995) model, which applies concepts from

Patterson's (1982) model, argues that antecedent conditions for undesired behaviors (e.g., deprivation of attention, presence of demands, use of punishments and disapprovals) result in certain events being established as reinforcing (i.e., parent attention, removal of requests for compliance), making undesired behaviors that were unintentionally reinforced in the past more likely to occur. Therefore, when problem behaviors occur, they are aversive to the parents, and their presence make escape from these behaviors available as a reinforcer. As a result, parent's behaviors that were previously reinforced by escape from problem behaviors are then more likely to occur.

Parental stress can also contribute to behavior problems in these children, and understanding parent behavior and the influences upon it is crucial in addressing behavior problems. Abidin's (1990, 1992) model of parenting and Belsky's theoretical framework on the determinants of the quality of parenting are both frameworks for understanding the complex nature of parent-child relationships, but they differ in their focus. Belsky's theoretical framework is a more comprehensive framework that considers a broader range of factors that influence the quality of parent-child interactions. On the other hand, Abidin's model focuses specifically on the role of parenting stress in shaping parent-child interactions and its impact on children. Abidin (1990, 1992) suggests that sociological, environmental, behavioral, and developmental variables influence parenting behavior and child adjustments. He suggests three separate components that contribute to the quality of parenting and the child outcomes: (a) parent characteristics; (b) child characteristics; and (c) situational/contextual factors. Child characteristics refer to the child's temperament, behavior, and developmental level. Parent characteristics refer to the parent's own psychological and emotional well-being, as well as their own parenting skills and beliefs.

Situational/contextual factors refer to external factors such as social support, financial resources, and family structure. Moreover, he proposes that parenting stress can have negative effects on both the parent and the child. For the parent, high levels of stress can lead to decreased parental confidence, increased negative feelings toward the child, and impaired parenting behavior. For the child, high levels of parenting stress can lead to increased behavior problems, decreased cognitive functioning, and impaired emotional development. In addition, high levels of parenting stress may affect a parent's ability to learn new parenting skills (Hastings & Beck, 2004). Based on this model, parenting is a balancing act between the child's needs and demands and the parent's access to available resources needed to meet those demands.

According to Abidin's model, when parents are faced with potential stressors, they first engage in a *primary appraisal* to determine whether the stressor represents a threat or challenge to their parenting role. Parents then engage in a *secondary appraisal* to evaluate their available resources to cope with the stressor. If parents perceive that they have adequate resources to cope with the stressor, they are more likely to engage in effective parenting behaviors. On the other hand, if parents perceive that they have insufficient resources, they may experience greater parenting stress and engage in less effective parenting behaviors.-For example, a parent who is struggling to manage their child's behavior may experience parenting stress. They may then engage in a secondary appraisal to evaluate their available resources, such as social support from family and friends, their parenting self-efficacy, and the quality of their parenting alliance with their partner. If they perceive that they have adequate resources, they may be more likely to use effective parenting strategies, such as positive reinforcement and the delivery of the appropriate contingent consequences. However, if they perceive that they have insufficient resources, they

may be more likely to use fewer effective strategies, such as punishment or withdrawal. In other words, parents will become stressed if they do not have the resources to cope with their child's behaviors.

Lazarus (1993) defined coping as "a person's ongoing efforts in thought and action to manage specific demands appraised as taxing or overwhelming" (p.8). According to the transactional model of stress and coping (Lazarus & Folkman, 1984), coping strategies can be effective in reducing parenting stress. One of the proposed coping strategies in the literature, is social support-seeking coping. This strategy involves seeking help or support from others, such as friends, family members, or professionals, to manage the stressor (Compas et al., 2001). Social support-seeking has been found to be particularly effective in reducing parenting stress, as it provides parents with resources, guidance and encouragement to manage the challenges of parenting (Crnic & Low, 2002; Meadan et al., 2010). For example, social support can offer parents validation and encouragement, practical help with childcare, and advice on how to deal with specific parenting challenges (Crnic et al., 2005). Furthermore, Glidden and Schoolcraft (2007) distinguished between two types of social support: formal and informal. Formal social support refers to assistance provided by professionals or formal organizations, such as counselors, therapists, parent support groups or parent training. In contrast, informal social support refers to the help and support received from family, friends, and acquaintances. Research has shown that both formal and informal social support can be important sources of coping for parents (Boyd, 2002; Bromely et al., 2004; Ling et al., 2011; Meadan et al., 2010; Plant & Sanders, 2007; White & Hastings, 2004). However, the type of support that parents prefer may vary depending on their individual circumstances and needs (Glidden & Schoolcraft, 2007).

Research has found that professional support can improve parenting behaviors and reduce parental stress (Milgrom et al., 2015; Petrocchi, 2020). A recent systematic review by Vernhet and colleagues (2019) examined coping strategies among parents of children with ASD. Results of their review supported the effectiveness of using problem-focused coping strategies and social support, such as parent training programs over the use of emotion-focused coping strategies, such as mindfulness-based stress reduction interventions (Rayan & Ahmad, 2017).

In conclusion, parental stress is a complex, multifaceted phenomenon that can negatively affect both the parent and the child. Parental stress can also affect the parent-child relationship in children with ASD, and understanding parent behavior and the influences upon it is crucial. To improve parent-child relationships and promote positive outcomes for both the parent and the child, it may be important to assess and address parenting stress and provide coping strategies in the form of support and resources to parents. Furthermore, research has shown that parent training programs are effective in improving parent-child interactions and reducing child behavior problems (Sanders et al., 2014). These programs provide parents with evidence-based strategies to promote positive behavior in their children and improve parent-child relationships. By improving parenting practices, parent training can contribute to reducing the risk of the child engaging in less desirable verbal behavior as a result of their lack of effective communication skills (i.e., verbal behavior), promote positive child outcomes, and improve parent-child interactions.

Parent Training

While previously faulty parenting practices were assumed to be the cause for ASD by some psychoanalytic explanations, such as Bettelheim in his (1967) book, *The empty fortress: Infantile autism and the birth of the self*, these notions were later widely criticized and eventually replaced by more evidence-based explanations (ex. Abrahams & Geschwind, 2008; Amaral et al., 2008; Mazefsky & White, 2014; Lyall et al., 2014; Schreibman, 2005). Instead, in the past 50 years, researchers in the field of behavior analysis have developed several sophisticated procedures and assessment strategies for behavioral parent training with the focus on teaching parents relevant skills that are necessary to maintaining success in natural environments (Lutzker & Guastaferro, 2018). Williams (1959) had one of the earliest documented applications of successful parent training in behavioral modification with a 22-month-old child who was brought in by his parents with what they described as violent tantrums at nighttime. Once medical causes were ruled out, observations revealed that the parents used to read to the child in bed to calm him down, inadvertently maintaining his undesirable behavior with positive reinforcement. Teaching the parents to ignore their child's tantrums (i.e., extinction) and successfully stopping that behavior, was the first study in literature to demonstrate the successful application of evidence-based procedures by parents. Parents of children with intellectual and developmental disabilities, including ASD, have been taught to implement a range of evidence-based strategies to address challenging behavior. These strategies include antecedent strategies and manipulation of motivational variables such as high probability request sequences (Knowles et al., 2015), behavior teaching such as functional communication training (Wacker et al., 2013), and consequence-based strategies such as differential reinforcement of incompatible behaviors

(Weston et al., 2018). Multi-component interventions that involve a combination of the previously mentioned strategies have also been successful (Lequia et al., 2013; Webster-Stratton & Herbert, 1993). There is also a growing body of evidence indicating that parents can learn and apply interventions to address common issues experienced by children with ASD and other developmental disabilities. These issues include sleep problems (Kirkpatrick et al., 2019; McLay et al., 2020), toilet training (Rinald & Mirenda, 2012), and feeding disorders (Johnson et al., 2019). Additionally, research has shown that parent training in behavior management can reduce the need for medications with potentially harmful side effects, like risperidone (Aman et al., 2009; Bearss et al., 2015).

Rationale for Including Parents

Nowadays, there is strong evidence to support parents' role in the active engagement in their children's educational and behavioral management by using effective parenting practices (i.e., monitoring, scaffolding, and reinforcing appropriate behaviors) (Patterson et al., 2016). In addition to increasing the skills acquired by children, various other positive effects have been documented. Perhaps the two most obvious benefits for parents' inclusion in their child's treatment or intervention implementation are (a) to facilitate the generalization and maintenance of newly taught skills to the home and across different settings (Brookman-Frazee et al. 2009; Wetherby and Woods 2008); and (b) to reduce parental stress as a reaction to the child issues, an important collateral effect of intervention (Matson et al., 2009). Other advantages found in the literature include (c) efficiency of services and (d) improving parent-child interactions (Matson et al., 2009).

Generalization and Maintenance

In the past 50 years, researchers in the field of behavior analysis have developed several sophisticated procedures and assessment strategies for behavioral parent training with the focus on teaching parents relevant skills that are necessary to maintaining success in natural environments (Lutzker & Guastaferro, 2018). Perhaps the generalization of newly learned skills from the school or the clinic to the home setting and relevant community settings is the most critical outcome of parent training programs (Brookman-Frazee et al. 2009; Wetherby & Woods 2008). When this model was followed, several researchers, including Baker et al. (1991), observed noticeable generalization from special education programs to the home. Similarly, using Planned Activities Training (PAT) to teach mothers to plan and structure activities to prevent challenging behaviors of children with developmental disabilities, Huynen et al. (1996) noticed that not only were the skills generalized across different settings, but also skills maintenance at 3-months follow-up were shown. Furthermore, Kaiser, et al. (1996) found similar results of skills generalization and maintenance at their 6-month follow up after training parents to assist their children to acquire verbal interaction skills.

Reducing Parental Stress

Parent training programs have provided parents with the knowledge, skills, and strategies necessary to manage their child's behavior effectively and enhance their child's social and verbal interaction skills (Erturk et al., 2020). Several studies have reported positive outcomes of parent training programs, including a reduction in parental stress and an improvement in child behavior and social skills (Baker-Ericzén et al., 2005; Bearss et al., 2015; Brookman-Frazee, 2004). For example, parent training programs that teach parents naturalistic or behavioral strategies to

increase their child's communication have been shown to result in decreased levels of parent stress (Feldman & Werner, 2002; Koegel et al., 1996). Additionally, research has demonstrated that effective parent training can lead to long-lasting positive effects on both parental and child outcomes (Feldman & Werner, 2002). Feldman and Werner (2002) evaluated the collateral effects of a behavioral parent training (BPT) program designed to teach parents and caregivers in using practical strategies to implement with their children with developmental and behavioral disorders. These strategies were focused on teaching parents how to use functional assessment-derived positive teaching strategies and emphasized addressing the antecedents to undesired behaviors, teaching the child alternative yet appropriate responses, and using reinforcement or extinction to modify behaviors. Parental stress was measured using the Questionnaire on Resources and Stress Short Form (QRS-SF; Holroyd, 1987). The positive effects of this training were lasting, as parents reported lower stress levels related to their child's condition and fewer disruptions to their quality of life up to 5 years later.

Efficiency of Services

Researchers assessing the benefits of parent training programs supported the notion that parent training increased the quantity and availability of interventions while requiring less time for children to demonstrate gains over clinic-only implementations (Lichtlé et al., 2020; McClannahan et al., 1982), and is aligned with objectives from large-scale policy initiatives (National Research Council, 2001; World Health Organization, 2016). Furthermore, parents who went through a parent training program have successfully trained other family members who regularly interact with their child in the use of the same strategies (Loughrey et al., 2014; Symon, 2005). Symon (2005) documented that following an intensive short-term parent training

program, parents who were trained to deliver intervention strategies using the techniques of Pivotal Response Training to their child, also effectively trained other family members and service providers to use those techniques. Her study presented findings from a week-long program designed to train parents of children with autism. The purpose of the program was to demonstrate that parents can acquire skills that enable them to effectively use strategies in their interactions with their children, as well as train other caregivers who work with their children. The research methodology involved single-case experimental design methods to evaluate the spread of effect on the caregivers who were trained by the parents. The results indicated that parents were successful in training the caregivers to implement the techniques taught during the program, and that the children showed improvements in their social communication (i.e., verbal behavior) and behavior during interactions with these caregivers.

Parent-child Interactions

Early research in parent training for children with ASD documented positive impacts on parent–child interactions. For example, Koegel et al. (1996) assessed the collateral effects of parent-implemented interventions on parent-child interactions during unstructured mealtime. He compared the effects of two behavioral interventions on two parent groups with children with ASD (n=17), one focused on teaching individual target behaviors (ITB), while the other used Pivotal Response Training (PRT). Parent interactions were rated using a rating scale that assessed parental behaviors on four different categories including stress and parental communication style. Post intervention assessments demonstrated that parent in the PRT group showed more improvements in their positive interactions. Results of their study showed that parent training may have broader effects, extending beyond the specific procedures that parents

were taught to use. Erturk et al. (2020), investigated how parent-implemented social communication (i.e., social-verbal interaction) interventions affected the verbal behavior skills of two young children with ASD. The parents in the study were given individualized training which started with didactic training, providing background information about the skill, general strategies, and skill-specific strategies, such as least-to-most prompting with time delay, environmental arrangement strategies, and reinforcement strategies. After the training sessions, the parents received coaching on each set of target skills. During the parent training sessions, the parents reviewed materials and training content, observed modeling, and engaged in role-playing with the researchers, and most importantly, practiced the targeted skills with their children while receiving immediate feedback. The parent training sessions continued until the parents reached a minimum of 80% treatment fidelity. The results indicated that parent training was effective in increasing parents' treatment fidelity, which in turn improved their children's social-verbal interaction skills during parent-child interactions. Moreover, Rocha et al. (2007) and Ingersoll and Wainer (2013) are another examples of studies that have implemented parent training programs to improve parent-child interactions by focusing on advancing the social-verbal interaction skills of children with ASD. Rocha et al. (2007) used the Teaching Interaction Procedure (TIP) to train parents how to implement Pivotal Response Training and Discrete Trial Teaching to improve joint attention skills. The study found that parents' accuracy in administering the strategies of the training improved, which resulted in an increase in joint attention bids provided to their children, and subsequently, the children's joint attention behaviors increased. Similarly, Ingersoll and Wainer (2013) used Behavioral Skills Training (BST) to train parents to implement components of a naturalistic behavioral intervention called

Project Impact to improve their children's social and verbal behavior skills. The study found that parents' implementation of the behavioral strategies improved, and their children also showed improvement in social and verbal behavior skills.

Evidence-Based Parent Training Programs

These days, there are many advertised parent training programs for families of children with ASD. Some of those programs are evidence-based, while others incorporate the use of evidence-based procedures in them without having any solid program evaluation, and naturally, there are also many programs that have absolutely no scientific evidence supporting them (Maffei-Almodovar & Sturmey, 2022). Back in 2011, Chorpita et al. conducted a systematic review on parent training programs that aimed to help parents of children with ASD, but they found only a few studies on the topic. However, research in this area has significantly grown since the publication of their meta-analysis. Several studies have been conducted in recent years to assess the effectiveness of parent training for children with ASD, as demonstrated by Beaudoin et al., (2014). Consequently, parent training has been recognized as an evidence-based intervention for individuals with ASD by the National Standards Project (NSP). A recent meta-analysis by Roberts et al. (2019) evaluated the association of parent training with child verbal behavior development in 79 studies. The study included 59 randomized clinical trials and 17 nonrandomized clinical trials including 5848 total participants (mean age, 3.5 years). They found that parent-implemented verbal behavior interventions were associated with verbal behavior development in children with or at risk of language impairment. Specifically, children with developmental language disorders had the largest significant positive associations between

parent training and children's communication, engagement, and speaker and listener skills outcomes. They also found that the association between parent training and parent use of verbal-behavior support strategies in their interactions was large.

In the following section, some of the current research and practices of different parent training models will be reviewed by focusing on (a) The content or the specific approach that parents are taught to use with their child. These are most likely determined by the child's verbal behavior developmental level and the type of targeted goals. This manuscript will also provide a few examples of a parent training program for each model; (b) The characteristics of effective parent training programs; (c) The delivery format of the different models.

Content of Parent Training Interventions

Some of the parent training interventions are based on one or more of the following models: behavioral methods, naturalistic behavioral methods, integrated developmental methods, and cognitive behavioral methods.

Behavioral Methods

This method is based on the principles of applied behavior analysis to teach parents the use of sophisticated behavioral procedures and concepts while working with their children (Baer et al., 1968). Behavioral methods assume that all operant behaviors are learned and "controlled by their consequences" (Skinner, 1953, p. 18). Therefore, these behaviors, such as language, play and, social interactions, are developed and maintained by observable and measurable environmental events (i.e., antecedents and consequences). Thus, appropriate target behaviors can be taught through the manipulation of these environmental variables. Such procedures

include the use of reinforcement (Lovas, 1987), prompting (Koegel & Koegel, 1987), fading (Cooper et al., 2020), shaping (Skinner, 1953), chaining (Binder et al., 2002), punishment (Azrin & Holz, 1966) as well as data collection. Behavioral methods emphasize the importance of using structured and adult-guided learning environments especially in the early stages of skill acquisition for children with ASD (Dawson & Osterling, 1997).

Discrete Trial Training (DTT). Lovaas et al. (1973) demonstrated one of the earliest benefits of using DTT when including parents in the application of their child's intervention plan. This was comprised of teaching small, measurable units of behaviors systematically using reinforcers (e.g., edibles or tokens) in carefully controlled environments. Koegel et al. (1996) further advanced the laboratory work of Lovaas and identified the basic critical steps that parent training programs should follow: (a) the use of clear antecedents or discriminative stimuli to inform the child that a consequence is available if they responded; (b) providing prompts as needed; (c) utilizing shaping and chaining to teach new skills. Lafasakis and Sturmey (2007) used this procedure to train three parents of children with ASD to implement DTT to teach their children gross motor imitation skills. All three parents demonstrated the acquisition and the generalization of that skill in targeting behaviors in novel programs, while the children also showed an increase in the number of correct responses, signifying the effectiveness of this method.

CABAS® Parent Education. The Comprehensive Application of Behavior Analysis to Schooling (CABAS®) is a system-wide approach to education. CABAS® schools use the principles of behavior analysis in every aspect of schooling, from curriculum development, to teaching, supervising, and training. CABAS® is a cybernetic system, that includes everyone

who's involved in the child's education, from teachers, assistants to university supervisors and parents (Singer-Dudek et al., 2021). In a CABAS® school, parents act as liaisons who facilitate the continuation of the child's learning outside of the school. This is done by offering parents individual and group parent training to teach them the use of different behavioral methods with their children.

Naturalistic Behavioral Methods

Early behavioral interventions were adult-directed and highly structured. As the field progressed, the need to increase the efficiency and the generalization of behavioral interventions led to the modifications of behavioral interventions to be more naturalistic. Naturalistic behavioral methods are less structured and are designed to embed teaching opportunities throughout the family's daily routines and in the child's natural environment, all while using developmentally appropriate toys and materials. This method grew from the desire to improve the efficiency and the generalization of behavioral intervention. Hart and Risley (1968) conducted the first naturalistic behavioral treatment to teach children with disabilities the use of descriptive adjectives. They taught them this skill in the context of their existent classroom activities. Naturalistic behavioral treatments occur with the following sequence: first, teaching takes place in the child's natural environment and during ongoing child-adult interactions, such as play or daily routines. Once the child indicates interest in an item or activity, the teaching episode begins. After that, using explicit prompts by the adult, the child produces the target response. The adult then delivers reinforcement and later loosely shapes the child's response to form into a more complex response (Kaiser et al., 1992). Rather than burdening the family with a direct teaching method that requires a lot of planning, naturalistic behavioral methods are

intended to be incorporated throughout the day as an interaction style that the parent can use with his/her child. Some of the popular naturalistic behavioral methods include *Incidental Teaching* (Hart & Risley, 1968), and *Pivotal Response Training* (Koegel et al., 1987).

Pivotal Response Training. Pivotal response training (PRT) is a behavioral intervention that was previously known as the Natural Language Paradigm (NLP; Laski et. al., 1988). It is a parent-mediated intervention for children with ASD, that uses the principles of Applied Behavior Analysis (Koegel & Koegel, 2018). PRT teaches parents to focus on targeting "pivotal' skills while adapting a more naturalistic approach. The word pivotal refers to a set of targeted skills (i.e., self-initiation, motivation for social contact, self-management, and responding to multiple cues) which, when successfully acquired, can produce more extensive positive gains in the child's other domains of functioning (e.g., eye contact, adaptive behavior), thus maximizing treatment gains. A review of the literature provided evidence that parents were successful in learning PRT techniques which resulted in improvements in their children's verbal behavior and social communication, and play skills (de Korte et al., 2022; Lei & Ventola, 2017; Nefdt et al., 2010; Ona et al., 2019; Verschuur et al., 2014). Furthermore, PRT showed to have a positive effect on parent-child interactions, as well as an increase in ratings of parental and child happiness, and a decrease in ratings of stress (Koegel & Bimbela, 1996).

Parent-Child Interaction Therapy. Parent Child Interaction Therapy (PCIT) is an evidence-based behavioral family approach designed for caregivers and their children ages 2-7 years old who are experiencing social, behavioral, and/or emotional difficulties, or exhibiting disruptive behavior problems (Eyberg, 1988). PCIT therapy consists of two phases of implementation: (1) Child-Directed Interaction Phase (CDI) which resembles traditional play

therapy, where caregivers are encouraged to "follow the child's lead," by developing child-centered play activates to enhance the parent-child relationship; and (2) the Parent-Directed Interaction Phase (PDI) where caregivers learn to use effective commands and implement additional behavior management strategies under the direction of the observing therapist (Eisenstadt et al., 1993). A main element of PCIT is the use of immediate feedback to the caregiver from the therapist (or coach) during parent-child interactions using a “bug-in-the-ear” system for communicating to the caregivers. Parents are taught to implement positive behavioral strategies such as the use of behavior-specific praise, differential reinforcement, and the delivery of appropriate contingent consequences following their child’s initiation of verbal behavior. Cooley et al. (2014), conducted a meta-analysis to measure the effectiveness of PCIT on child’s behaviors as well as parenting stress as an outcome of interest as reported by 11 studies. Results from the meta-analysis suggest that PCIT had a generally positive impact in reducing child problem behaviors and a significantly reduced parenting stress.

Integrated Developmental and Behavioral Methods

Starting in the early 1980s and based on the integration of the social-pragmatic model of language acquisition (Bruner, 1983) and the Piagetian developmental psychology and psychoanalytic theory (Greenspan & Lourie, 1981), developmental interventions in the treatment of ASD began. Following the developmental theory as the guiding principle of this approach, this method uses typical developmental sequences as the content for their interventions while using teaching strategies derived from the principles of applied behavior analysis (Rogers & Ozonoff, 2006). The integrated developmental and behavioral method came about from the need

to develop meaningful developmental growth in infants and toddlers to address their specific developmental needs. This approach emphasizes the need for the development of the full range of interpersonal social-verbal interactions, including teaching pre-vocal verbal behavioral skills (e.g., joint attention, imitation, intonations, and shared affect). This model is similar to the naturalistic behavioral model in attempting to elicit child initiations by rearranging the child's natural environment (i.e., child-directed). Once the child initiates a response, the adult follows the child's lead and attempts to expand on the child's response by using modeling and imitation (Mahoney & Perales, 2003) Some of the examples for the integrated developmental and behavioral method include: *The Early Start Denver Model* (Rogers et al., 1986), *The Developmental Social-Pragmatic Curriculum* (Ingersoll & Dvortcsak, 2006), and *Incredible Years Parent Training Model* (Webster-Stratton, 2001).

Incredible Years®-ASLD (IY-ASLD®). The Incredible Years® Parent Program, specifically, IY-BASIC®, is an evidence-based group parenting curriculum to reduce children's conduct problems, enhance parental efficacy, and promote children's academic, emotional, and social skills. Based on principles of operant and social learning theories, Webster-Stratton created the IY program in the 1980s. The program is delivered in approximately 12 weekly sessions, and utilizes videotape modeling, role playing, rehearsal, and weekly homework activities in small groups of 8–14 parents. It covers topics in five main areas: play, praise, rewards, limit-setting, and handling challenging behavior. Multiple randomized control trials (RCTs) have demonstrated the effectiveness of IY-BASIC® in reducing parenting stress and depression and in decreasing undesired child behaviors in families with a child with behavior problems (Gardner, & Leijten, 2017; Jones et al., 2007). A recent meta-analysis of over 50

studies showed significant effects for improved parental mental health and reduced child behavior problems in both treatment conditions and in prevention trials for IY-BASIC (Menting et al., 2013). Only a handful of studies have evaluated the IY-ASLD® and they specifically assessed the feasibility and the parental satisfaction of the program (Dababnah & Parish, 2016; Hutchings, et al., 2016; Webster-Stratton, et al., 2018; Williams et al, 2020). Dababnah and Parish (2016) implemented an earlier version of the IY-ASLD program with 17 parents using a pre-post design. Although the program did not include children with ASD in the video vignettes, it resulted in a significant decrease in parental stress following program completion. Qualitative findings indicated that parents appreciated the program's focus on meeting each child's developmental needs and reported improved relationships with their child. Hutchings et al. (2016) conducted a small pilot study with 9 parents and used parent reports to evaluate the program. The study found that parents were highly satisfied with the program, particularly finding the video vignettes, group discussion, and shared problem-solving useful. Williams et al. (2020) conducted the only randomized control trial (RCT) of the IY-ASLD® program to date. The study was designed to assess the feasibility and acceptability of the program with 58 parents of children aged 3-8 years with a diagnosis of ASD. The treatment was implemented across four specialist children's centers in Wales, with half of the families receiving IY-ASLD® treatment immediately and half being waitlisted to a treatment-as-usual control condition. The study found good levels of acceptability by parents but was limited in its use of observational data due to logistical challenges that led to missing data from parent-child observations. The study was not powered to detect differences in outcomes.

The Incredible Years-ASLD® program adapted the IY-BASIC® to specifically target the needs of parents with children with ASD and language delays such as communication difficulties, social interaction challenges, and sensory sensitivities. This program places a strong emphasis on the involvement of parents in their child's development and begins with teaching parents the foundational strategies to increase responsive parenting skills and to build positive parent-child relationships. It covers eight different topics: (1) child-directed narrated play; (2) pre-academic and persistence coaching; (3) social skills; (4) emotion coaching; (5) developing imagination through pretend play; (6) promoting children's self-regulation skills; (7) using positive reinforcement to motivate children; and (8) effective limit-setting and behavior management. The core program principles and objectives are outlined in (Appendix A). This program continues to utilize video vignettes, group discussion, role-play to practice skills, and home activities (Webster-Stratton, 2015). The program is delivered in 12-14 weekly, two-hour sessions. Compared to the IY-BASIC®, the IY-ASLD® program has an increased emphasis on the importance of providing children with opportunities to engage in social-verbal behaviors, such as through play, to build their verbal behavior, empathy, social skills, and behavior-regulation. Due to the communication difficulties of children with ASD, parents learn to assess their child's verbal behavior levels and use developmentally appropriate language to promote social communication. The program emphasizes a functional approach to behavior change, where parents learn the "ABCs" of behavior, by identifying (A) the antecedent that precedes a behavior, (B) the behavior itself, and (C) the consequences that maintain it. With that, parents learn ways to shape desired behaviors and deliver reinforcement to maintain them.

Within the IY-ASLD main topics, the first two, which are revisited throughout the program, are designed to promote positive parent-child interactions and the child's verbal behavior development. The first is the 'child-directed narrated' play, and the use of 'descriptive narrated coaching' which teaches parents how to increase their children's joint attention skills by leveraging their play interests and sensory needs, getting into their "attention spotlight," engaging in pretend play, and using puppets as means of establishing joint attention and shared enjoyment in play. Parents also learn to follow the child's lead during play and to use descriptive commenting on the child's actions, imitating the child, and modeling and prompting play behaviors and verbal behaviors. In addition, the IY-ASLD has several key objectives, which aim to promote positive parent-child interactions and support children's language and social development. They are taught to encourage social communication by using language that is tailored to their child's level of verbal ability, by waiting for their child's response before responding themselves, and by demonstrating enthusiasm for their child's actions. Parents also learn to use behavior-specific praise, to minimize the number of commands they give and instead use clear, concise, positive instructions, and to selectively ignore unwanted behaviors. The overall goal of the program is to facilitate effective communication and decrease challenging behaviors among children.

Cognitive Behavioral Methods

Cognitive behavioral therapy (CBT) is a type of psychotherapeutic treatment. Review of the trajectory of development in school age children and adolescents with ASD showed two things: (a) despite the continued pervasive impairments in their social and comprehension skills,

their symptoms of ASD, especially in communication deficits, might become less apparent as they age (Seltzer et al., 2004), while (b) the prevalence of comorbid psychiatric diagnosis increases (Simonoff et al., 2008). Studies have shown that anxiety and depression affect 22-84% of the school-age children and adolescents with ASD (de Bruin et al., 2007; Ghaziuddin et al., 1998; Green et al., 2000; Kim et al., 2000; Leyfer et al., 2006). Therefore, the focus of interventions for this population have shifted to teaching them strategies that are adequate with their cognitive and verbal abilities to help them cope with these challenges (Matson, 2009).

Family Cognitive-Behavioral Therapy (FCBT). The emphasis of this model is on teaching the adolescent cognitive coping strategies that include: (a) self-monitoring: the child and the therapist identify maladaptive cognitions using discussions and questioning; (b) emotional identification and recognition; (c) cognitive restructuring: they question the validity of the identified cognition; (d) and problem-solving: they correct the cognitive distortions. A hierarchy of feared situations are ordered from least to most distressing and the child is taught to work his way up and is rewarded for attempting increasingly more distressing activities. First, children learn these coping strategies in the treatment room, before gradually transitioning into more naturalistic settings until the child masters the skill in the actual setting. This occurs while the clinician is providing immediate feedback and reinforcement to increase the child's motivation and reach habituation. Parents are also trained to implement cognitive-behavioral strategies with their children to allow them to achieve mastery in different settings (Reaven & Hepburn, 2006).

Delivery Formats of Parent Training Interventions

Individual Format

An individual (i.e., one-to-one) parent training approach has several documented advantages (Kaiser & Hancock, 2003). Most importantly, teaching and intervention strategies used are more individualized and tailored to specific family and child needs. They also facilitate the parents' active learning with ample opportunities to practice newly learned procedures while receiving direct and immediate feedback from the clinician (Gillett & LeBlanc, 2007). Furthermore, while parent training sessions in the school or the clinic might provide a distraction-free environment that can help in the acceleration of the parent's initial acquisition of new skills, the flexibility provided by the individual format in choosing the teaching location, such as the child's home, can accelerate the child's generalization and maintenance of new skills (Wetherby et al., 2014)

Group Format

Group format in parent training sessions offers different advantages over the individual format. These models are less time-intensive and more cost-efficient since the clinician can work with several families at the same time. Group format also provides families with the opportunity to learn from each other's experiences and receive social support from others with similar parenting challenges (Crnic et al., 2005). Typically, a group training format includes (1) instruction; (2) modeling (i.e., mostly through videotape exemplars); (3) role-playing, and (4) group discussions and problem-solving.

Virtual Format

Through the use of the latest communication technologies, internet-based interventions have the benefit to assist in the delivery of education and medical treatment in a cost-efficient, accessible, and a flexible way (Baggett et al., 2010; Ferguson et al., 2019). Telehealth Services have extended beyond the reach of the traditional face-to-face model, transforming the healthcare system at a breathtaking rate. "The term telehealth refers to the entire spectrum of activities used to deliver care at a distance without direct physical contact" (Wosik et al., 2020, p. 957).

The use of telehealth in the education and health fields is not new; several researchers have capitalized on the use of tele-communication software to deliver training and remote communication (Ferguson et al., 2019). Evidence for its potential advantage of providing cost-effective access to evidence-based interventions in rural and underserved areas has been documented in several studies (Griffiths et al., 2006; Myers et al., 2008). Moreover, telehealth interventions have demonstrated to offer some benefits that could augment or replace the traditional face-to-face model (for example, self-paced interventions, convenience of on-demand accessibility, and the option to repeat a lesson if needed).

Rationale for Current Study

Basic and applied research studies have identified the environmental contingencies and reinforcers that facilitate verbal behavior development. Their work was built on Skinner's (1957) theory of Verbal Behavior by providing empirical evidence showing that the advancement of a child's verbal behavior is closely tied to their engagement in reciprocal social verbal episodes,

which results in the establishment of new conditioned social reinforcers (Greer & Ross, 2008; Greer & Du, 2015; Keohane et al., 2009). Therefore, a child's early language environment is critical, and their parents' active engagement during parent-child interactions in providing a qualitatively and quantitatively rich verbal environment plays a vital role in facilitating the development of complex social reinforcers, and the growth of their verbal behavior (Rowe, 2008).

More importantly, the review of the literature revealed a few determinants that might affect the quality and quantity of parent-child interactions. Belsky's (1984) theoretical framework highlights the complex interplay between child characteristics, parent characteristics, and contextual factors in shaping parent-child interactions. In the context of children with ASD, child characteristics, such as deficits in their social-verbal interactions and verbal behavior, require more service utilization and can have implications on their early interactions with adults, leading to fewer interactions than neurotypical children (Warren et al., 2010). Parent characteristics such as parental stress is another factor, with parents of children with ASD reporting higher levels of parenting stress than those of typically developing children or those with other disabilities (Hayes & Watson, 2013). Several studies have linked parental stress to several negative parent behavior attributes, including decreased responsiveness to child's initiations, reduced use of positive language, increased use of negative more controlling language, and decreased use of complex and descriptive language (Beckerman et al., 2018; Crnic et al., 2005), which in turn, could affect the child's outcomes (Rowe, 2008; Shalev et al., 2020). These findings emphasize the bidirectional influence between the child and the parent's behavior, which should be taken into account when assessing and intervening with this population (Hastings, 2002; Patterson et

al., 2004). Patterson's (1990) behavioral model of coercive parenting suggests that effective parent behaviors require a balance of structure and consistent reinforcement.

Abidin's (1990, 1992) model of parental stress suggests that when parents are faced with stressors, they engage in a primary appraisal to determine whether the stressor represents a threat or a challenge. Parents then engage in a secondary appraisal to evaluate the available resources to cope with the stressors. For example, contextual factors, such as the barriers these parents face when seeking diagnosis, early intervention, parent education, and related services, while navigating disconnected service systems, limited availability of services, and long waiting lists, leads to significant stress for parents (Estes et al., 2013; Newman et al., 2014). Research has found that social support, specifically in the form of formal support from professionals, such as parent training, can improve parenting behaviors and reduce parental stress (Crnic & Low, 2002; Meadan et al., 2010). Parent training is a strategy used to bolster the amount of intervention a child receives, maintain, and generalize trained skills to other settings (Wetherby & Woods 2008), improve the quality and quantity of parent-child interactions (Rocha et al., 2007) and reduce parental stress (Bearss et al., 2015) in a cost-effective way (Lichtlé et al., 2020). The Incredible Years® (IY-ASLD®) is a parent training program designed for parents of young children with ASD and/or language delays. The program is based on the principles of social learning theory and is structured around a series of modules covering topics that focus on teaching parents positive parenting skills and effective strategies for improving their child's verbal behavior and social-verbal interaction skills. The Incredible Years-ASLD® program has several key objectives to promote positive parent-child interactions and support children's language and social development. Parents are taught to create language-rich environments

through child-directed play and descriptive commenting. They learn to encourage reciprocal communication by using language appropriate to their child's verbal level, by pausing to wait for the child's response, and to respond enthusiastically to their child's initiations. Parents are also taught to use behavior-specific praise, to reduce the number of commands and give clear, brief, positive instructions, and to selectively ignore undesirable behaviors. Overall, the program aims to foster effective communication and reduce challenging behaviors in children.

In the year 2020, the World Health Organization (WHO) declared the novel Coronavirus disease 2019 (COVID-19) event a pandemic. To mitigate the spread of the virus, stay-at-home orders and school closures were put in place, for the most part, all around the globe. Reducing in-person contact and enforcing social distancing measures was deemed an essential factor in slowing down transmission. Although necessary, these mitigation strategies have critically hindered access to vital services needed by individuals with disabilities, leaving them with incredibly insufficient resources. Perhaps offering evidence-based parent training via telehealth during this pandemic and beyond will enable access to treatment in a naturalistic home setting, improving accessibility, convenience, and generalization of skills.

Research Questions

Question 1.

What were the effects of the IY-ASLD® intervention on the **quantity** of mother-child interactions across all three conditions, as measured by the number of verbal operants initiated by the mothers, and the number of approvals vs. disapprovals? We hypothesized that following the intervention, there would be an increase in the number of tacts and approvals emitted by the mothers, and a decrease in the number of mands and disapprovals.

Question 1a.

What were the effects of the IY-ASLD® intervention on the number of mothers' tacts in both tasks across all three conditions?

Hypothesis 1a. Mothers will emit more tacts following the intervention.

Question 1b.

What were the effects of the IY-ASLD® intervention on the number of mothers' mands in both tasks across all three conditions?

Hypothesis 1b. Mothers will emit fewer mands following the intervention.

Question 1c.

What were the effects of the IY-ASLD® intervention on the number of mothers' approvals in both tasks across all three conditions?

Hypothesis 1a. Mothers will emit more approvals following the intervention.

Question 1d.

What were the effects of the IY-ASLD® intervention on the number of mothers' disapprovals in both tasks across all three conditions?

Hypothesis 1b. Mothers will emit fewer disapprovals following the intervention.

Question 2

What were the effects of the IY-ASLD® intervention on the **quality** of mother-child interactions across all three conditions, as measured by mothers' responsiveness to their children's initiations, mothers' effectiveness in eliciting a response from their children, and on the number of missed opportunities (no responses) for both? We hypothesized that following the intervention, there will be an increase in the number of mothers' responses to their children's initiations, and the number of children's responses to mothers' initiations. We also hypothesize that there will be a decrease in the number of missed opportunities for both.

Question 2a.

Were the mothers more responsive to their children, as measured by the effects of the IY-ASLD® intervention on the number of mothers' responses to children's initiations (i.e., mothers' responses) across all three conditions?

Hypothesis 2a. Mothers will be more responsive to their children's initiations.

Question 2b.

Were the mothers more effective in eliciting a response from their children after the intervention, as measured by the effects of the IY-ASLD® intervention on the number of children's responses to mothers' initiations (i.e., children's responses) across all three conditions?

Hypothesis 2b. Mothers will elicit more responses from their children.

Question 2c.

What were the effects of the IY-ASLD® intervention on the number of missed opportunities for both, as measured by the effects of the IY-ASLD® intervention on the number of mothers' no responses to children's initiations, and the number of children's no responses to mothers' initiations across all three conditions?

Hypothesis 2c. The number of mothers' missed opportunities will decrease.

Hypothesis 2d. The number of children' missed opportunities will decrease.

Question 3.

Were there correlations between parental stress, as measured by mothers' self-reported Parenting-Stress Index (PSI-4), and the quality and quantity of parent-child interactions, as measured by the number of mothers' responsiveness to children's initiations (i.e., mothers' responses) and the number of mands, tacts, approvals, and disapprovals emitted by the mothers in both tasks before and after the intervention? Based on research on the characteristics of stressed mothers' language, we hypothesized that there will be a negative association between parental stress and mothers' responsiveness to their children's initiations, their use of positive language (i.e., approvals), and their use of descriptive language (i.e., tacts). We also hypothesized that there will be a positive association between parental stress and their use of negative language (i.e., disapprovals), and controlling language (i.e., mands).

Question 3a.

Were mothers' stress levels associated with how responsive they were to their children, as measured by the correlation between parental stress (PSI-4) and the number of child-initiated responses that were responded to by the mothers (i.e., mothers' responses) before and after the intervention?

Hypothesis 3a. There will be a negative association between parental stress and mothers' responsiveness to their children's initiations.

Question 3b.

Were mothers' stress levels associated with their use of descriptive language, as measured by the correlation between parental stress and the number of *tacts* emitted by the mothers before and after the intervention?

Hypothesis 3b. There will be a negative association between parental stress and the number of tacts emitted by stressed mothers.

Question 3c.

Were mothers' stress levels associated with their use of more controlling language, as measured by the correlation between parental stress and the number of *mands* emitted by the mothers before and after the intervention?

Hypothesis 3c. There will be a positive association between parental stress and the number of mands emitted by stressed mothers.

Question 3d.

Were mothers' stress levels associated with their use of positive vs. negative language, as measured by the correlation between parental stress and the number of *approvals* and *disapprovals* emitted by the mothers before and after the intervention?

Hypothesis 3d. There will be a negative association between parental stress and the number of approvals emitted by stressed mothers.

Hypothesis 3e. There will be a positive association between parental stress and the number of disapprovals emitted by stressed mothers.

Chapter 2: Method

Participants

Participants included seventeen biological mother-child dyads with children who attended a full-day, intensive Applied Behavior Analysis (ABA) preschool in a suburb of a large city in the northeastern United States. School districts refer at-risk children or children who have been diagnosed with ASD to this school. We obtained Institutional Review Board (IRB) approval for the study from the ABA School and from the University IRB.

Mothers' ages ranged from 27 to 45 years (M = 36.93, SD = 5.14) and a majority were born within the US (59%). Mothers identified themselves as White (n=12; 71%), Latinx (n=3; 18%), Black (n=1; 6%), or Asian or Pacific Islander (n=2; 12%). Most mothers held a bachelor's degree or higher (n=16; 94%). Most mothers reported having a co-parent who was the child's biological parent (n=16; 94%). About half of participants were employed full time with (47%) and the rest were employed part-time (12%) or unemployed (35%). Household incomes ranged from high (53% at $200,000 or more) to medium (30% at $75,000- $199,999) to low (17% at below $75,000). [*Note*: In the region an income of below $68,720 for a family of four is categorized as *low-income*.] Participants' families had a mean of 1.94 children and 2.0 adults in the household. Two families (12%) had another child with a developmental delay.

Child participants were mostly male (88%) with a mean age of 4 years and 3 months (range 34 to 60 months) and had very low adaptive behavior as measured by the Vineland Adaptive Behavior Scale (VABS; mean composite standard score of 70, range of 64 to 85). The most severe adaptive behavior deficits were in children's Socialization Skills, with a mean domain score of 63 (SD ±12.25). Children were also reported to have overall low level of Daily

Living Skills (mean domain score of 72, SD ± 7.32) and Communication Skills (mean domain score of 76, SD ± 8.23).

In ELCAR assessments, children demonstrated an average of 31 out of 95 repertoires across the three verbal behavior domains (Verbal Behavior Foundations, Listener, Speaker). Child participants were categorized as either "high-VB" or "low-VB". High-VB children demonstrated 23 or more repertoires across the three verbal behavior domains, while low-VB children demonstrated 22 or fewer repertoires. Low-VB children performed at lower levels on both communication assessments (VABS-Comm and ELCAR). Low-VB children had an average VABS-Comm score of 71, while High-VB children had an average score of 81. Low-VB children demonstrated an average of 13 ELCAR repertories while High- VB children demonstrated an average of 49 repertoires. Children's scores on the ELCAR VB repertoires and the VABS-Composite ($r\ (17) = .734$, $p<.001$) as well as the ELCAR VB repertoires and VABS-Comm subscale were highly correlated ($r\ (17) = .687$, $p=.002$), indicating that both are reliable measures of the child's developmental level. Table 1 summarizes demographic, child, and maternal characteristics.

Inclusion Criteria

To be included, children had to be a) ages 2 to 5 years old and b) have an Individual Education Program (IEP) for a preschooler with a disability (as the state does not use specific disability classifications until kindergarten) or an Individualized Family Service Plan (IFSP) for children enrolled in Early Intervention (0-3 years) that mandated speech and language services. They were also assessed for ASD using the CARS-2-SF. Mothers had to speak and read English fluently and be able to commit to a 3-month intervention and assessment sequence.

Recruitment

We sent paper flyers and emails to over 100 parents informing them about the program with links to an informational website and a QR code to access the digital sign-up form. Over a 1-month period in early 2021, 42 caregivers completed the sign-up form and consented to a screening call. Twenty-three caregivers were determined to be eligible and interested in participating in the program and received consent forms. Following consent, 20 participants ultimately enrolled to begin the intervention. We then assigned the participants into groups based on the child's level of verbal behavior (i.e., listener-only, listener and speaker, listener-speaker joined) and the parent's availability. Following group assignment, three additional participants withdrew within the first week for personal or scheduling reasons. A total of 17 participants attended the first group and completed the pre-intervention assessments, including Qualtrics surveys and parent-child interactions. All 17 participants completed the 12-week program and completed all assessments except for one parent who was not available for the PCI mid-treatment.

Settings and Materials

Parent-child interaction (PCI) sessions took place virtually at each participants' home. Parent-child dyads were asked to sit at a table in an enclosed room with minimal distractions, and to place a laptop or a tablet across from where they are seated and to remain in the frame of the camera. Each participant was asked to prepare a list of items to be used during the PCI sessions. These items included a) crayons, b) two blank sheets of paper, , and c) a variety of the child's preferred toys, such as shape sorters, pop-up toys, Magna-Tiles®, connect four or toy

vehicles. Refer to (Appendix B) for a copy of the instructions given to each participant prior to the beginning of the PCI assessment sessions.

All 12 sessions of IY-ASLD® parent program, and the three parent-child interaction assessments (i.e., pre-intervention, mid-intervention, post-intervention) were recorded remotely via Zoom Healthcare, a video conferencing platform that is encrypted to protect the confidentiality of all participants. Zoom Healthcare fully complies with the Health Insurance Portability and Accountability Act (HIPPA) Security Standards. Zoom Healthcare employs Advanced Encryption Standard (AES) using 256-bit keys to protect meetings. Default settings for Zoom Healthcare accounts automatically ensure that meetings access is password-protected. Only members invited by account administrators were able to host Zoom meetings. All video data were saved to a virtual desktop and then uploaded directly to a file stored on a TC password-protected and HIPAA-compliant Google share drive, which includes more secure and restrictive versions of Gmail, Drive, Meet, and Calendar.

Measures

Measures of Verbal Behaviors

Verbal behaviors were defined by the social interactions and exchanges of listener and speaker responses in a rotated fashion between the parent and the child to capture each response. Verbal behavior encompasses the range of interactions in which individuals seek to affect the behavior of others, or to be affected by the behavior of others. Skinner distinguished between verbal and vocal, as verbal includes all means of interaction with an audience, not limited to the speaking topography. Verbal behavior focuses on the function of communicative behaviors rather than the structure or the lexicon of communication. Verbal behavior also differs from the

structural approach in that verbal behavior includes non-vocal social interactions such as frowns, smiles, grimaces, and gestures.

In this study, this was measured by the number of verbal operants, approvals and disapprovals. Each verbal behavior emitted with a function to communicate, was also categorized based on its form: vocal verbal behavior (VB), non-lexical vocal verbal behavior (NL), or non-vocal verbal behavior (NV).

Verbal operants. Below are the definitions used to code each type of verbal operant from the transcript.

Mands. Mands are vocal, non-lexical or non-vocal verbal operants that occur under conditions of motivation, deprivation, or aversive stimulation, and are reinforced by the presentation of the desired stimulus or the removal of the aversive stimulus (Greer & Ross, 2008). Mands could have several functions including mands for attention, mands for an object, and mands for information. Examples include "look here," "pick up the crayon," "How are you doing?" "Which one do you want?".

Tacts. Skinner (1957) defined the tact as a "verbal operant in which a response of a given form is evoked by a particular object or event or property of an object or event" (pp. 81– 82). Tacts are vocal, non-lexical or non-vocal verbal operants that occur under non-verbal stimulus control and are maintained by generalized reinforcement (Skinner, 1957). Examples include "that's a square", "Mommy is opening the book", "I found it!", and "here is a flower, so pretty".

Approvals. Approvals are vocal, non-lexical or non-vocal verbal behaviors emitted by the parent and directed to the child to endorse, commend, or praise the correct, or desired behaviors, or a positive attempt to engage the child. Vocal approvals were approvals delivered vocally with

audible sounds (e.g., "Good job!" "Thank you, honey," "I love you"), or by echoing the child's vocal verbal behavior (e.g., child tacts "baby" and mom responds with "a baby!"). Non-lexical approvals were vocal responses that did not contain real words, such as laughs or approving sounds (e.g., "Weee!"). Non-vocal approvals were defined as approvals delivered through gestures, or physical contact (e.g., a thumbs up, a clap), or physical contact (e.g., high fives, fist bump, hugs, tickle, kiss).

Disapprovals: Disapprovals are vocal, non-lexical or non-vocal verbal behaviors emitted by the parent toward their child to reprimand or punish inappropriate behaviors or to express overt disagreement. Vocal disapprovals included reprimands delivered with audible sounds (e.g., "No," "Stop that," "Don't do that," "That's not right"). Non-lexical disapprovals were vocal responses that did not contain real words, such as "Uh-uh" (to indicate "no, don't do that"). Non-vocal disapprovals were defined as reprimands delivered in the form of gestures (e.g., a finger or a palm held up to represent "No" or "Stop"), or physical contact (e.g., slaps, hits, kicks, or pushing hands away).

Speaker Response. We categorized each speaker response based on its form into one of three categories: vocal verbal behavior (VB), non-lexical vocal verbal behavior (NL), or non-vocal verbal behavior (NV).

Vocal Verbal Behaviors (VB). Vocal verbal behaviors consist of speaker responses emitted across verbal operants. These are communicative responses that function as either initiations or responses between two or more persons in the same verbal community (i.e., conversation). Vocal verbal responses are audible responses, in the form of lexical vocalizations containing words, phrases, or sentences. Examples include spoken sentences, words, and clear

word attempts (e.g., child attempting to say the word “car” with “kaa”). Instances of vocal verbal behaviors were included in counts of conversational units.

Vocal Non-Lexical Behavior (NL). Non-lexical vocal verbal behaviors consist of communicative speaker responses emitted across verbal operants with the same controlling variables and reinforcing functions as vocal verbal behaviors. The differences are exhibited in the form of the responses in which the audible vocalizations do not contain lexicons. Example: laughs, hmmm, grunts, a cry, whine, whimper. Instances of vocal non-lexical responses were included in counts of conversational units.

Non-Vocal Verbal Behavior (NV). Non-vocal verbal behaviors consist of communicative speaker responses emitted across verbal operants delivered in a non-vocal form with the same controlling variables and reinforcing functions as vocal verbal behavior. The differences are exhibited in the form of the responses. Gestures and actions are used as non-vocal functions to communicate, but no audible response is emitted. Examples include pushing an object away (“I don’t want that”), waving (“hello”), pointing to an object (either “I want that” or identifying the answer to a question), head nod (“yes”), and head shake (“no”). Note that non-vocal facial expressions were not coded due to frequent intervals of parent or child’s full face not being in view. Instances of non-vocal verbal reinforcement were included in counts of conversational units.

Listener Response. Listener responses are observable verbal behaviors that were directly relevant to previous vocal verbal behavior. Examples included observing or orienting head/eyes towards the speaker (i.e., observing responses) or object the speaker had or was pointing at (i.e., joint attention), compliance with a directive (not including vocal behavior), or clear

noncompliance with a directive. Instances of listener-only reinforcement were not included in counts of conversational units.

No Response (NR). No responses encompassed both vocal non-verbal behaviors that had no communicative functions or the lack of response.

Vocal Non-Verbal Behavior. Vocal non-verbal behaviors consist of speaker responses, or audible responses, in the form of lexical words, phrases, or sentences that did not have observable stimulus relations, such as vocal stereotypy (i.e., palilalia or echolalia). These behaviors were recorded as *No Response* and not as a verbal behavior response since the function of the behavior was unknown.

No Response. We defined a *No Response* as the occurrence of a 3 s intra-response time (IRT) in which no observable verbal behavior was emitted by the listener or the speaker following the end of the most recent response.

Demographic Measures

Caregivers answered questions regarding demographic and family characteristics including caregiver and child age and caregiver level of education, marital status, ethnicity, and family income.

Measures of Child Functioning

Measures of child functioning were collected to verify the child's diagnosis of autism and to determine their levels of verbal behaviors to assign their parents in the appropriate parent training group.

Childhood Autism Rating Scale- Second Edition (CARS-2; Schopler et al., 2010). The CARS-2, completed by the classroom teacher and a PhD-level clinician, was used to verify

an ASD diagnosis for purposes of sample description. Using the updated cutoff on the CARS-2 (Ji et al., 2023; Moon et al., 2019), 12 children (71%) were in the clinical range for ASD; 4 children (24%) were in the unspecified developmental delay range, and 1 child (6%) fell below the clinical cut offs in the normal range. The CARS-2 shows adequate reliability (α = .79) (Garfin et al., 1988), predicts clinical decisions and ADI-R results (Pilowsky et al., 1998), and correlates highly with the ADOS-2 (manual reports an *r* of .79).

Vineland Adaptive Behavior Scale-Third Edition (VABS-III; Sparrow et al., 2016). The Vineland Teacher Rating Form, Communication Domain measures receptive, expressive, and written language and was completed by the participating child's classroom teacher (α=.97 standardization sample). The VABS-II Communication domain is highly correlated with cognitive ability in children with ASD (*r* =.80) (Perry et al., 2009), and it was used as a measure of the child's verbal ability.

Early Learner Curriculum and Achievement Record (ELCAR; Greer, et al., 2018). The ELCAR is a criterion-referenced comprehensive curriculum and assessment of repertoires needed for a child to succeed in early childhood education. The ELCAR lists repertoires across Verbal Behavior Foundations, Listener, Speaker, Self-Management, Academic Literacy, and Physical Development domains. The ELCAR additionally functions as a curriculum for students who are missing critical repertoires identified through the assessment. Further, the ELCAR is sequenced to identify when children are missing critical verbal developmental cusps and capabilities such that the teacher can determine which verbal behavior interventions the student needs. Singer-Dudek et al. (2023) have demonstrated evidence of its convergent validity with the Vineland Adaptive Behavior Scale-3 (Vineland-3) Teacher Rating Form Communication

domain, Autism Diagnostic Observation Schedule-2 (ADOS-2) module and observed child-initiated joint attention (IJA). The study also demonstrated its divergent validity with the Sensory Experience Questionnaire (SEQ), Child Behavior Checklist externalizing scale (CBCL/1.5–5), and child response to mother-initiated joint attention (RJA).

Measures of Maternal Mental Health

Parental Stress (Parenting Stress Index)- Fourth Edition, Short Form (PSI-4: SF) (Abidin, 2012) The PSI-SF is a 36-item self-report scale containing three empirically derived subscales across three subdomains: parental distress, parent-child dysfunctional interaction, and difficult child, all of which contribute to total parenting stress. Responses are completed on a 5-point Likert scale. This measure includes items such as: "I feel trapped by my responsibilities as a parent" and "Since having a child, I feel that I am almost never able to do things that I like to do." The PSI has excellent internal consistency as reported by the authors (α=0.95) and in this sample (α=.94). Construct validity as a measure of parenting stress is strong, based on extensive research as reported in the manual.

Procedure

Process to Collect Measures of Parental Stress

Caregivers completed a total of two questionnaires via Qualtrics, an online survey tool, which was securely protected by Teachers College IT. The two questionnaires were completed at two different timepoints: pre-intervention, and post-intervention. Participants received individualized links to the survey to protect their identity in the Qualtrics system via a standardized email by each group therapist using the lab email address. The initial pre-treatment

questionnaire was given one week prior to beginning the Incredible Years group and included the following: demographics and parenting stress (PSI-4SF). The final post intervention questionnaire was given at the conclusion of treatment, after week 13.

Intervention. The Incredible Years-ASLD® (IY-ASLD®).

The intervention consisted of weekly 90-minute sessions that were conducted via Zoom. Based on each child's levels of verbal behavior and the caregiver's stated time of availability, we divided the participants into four groups of four to five caregivers. Four clinicians implemented the 12-week IY-ASLD® treatment concurrently: with groups meeting at different days and times. Outside of weekly group sessions, parents were provided with worksheets, handouts, and assignments to guide their application of learned skills in the home environment. In addition, reading from the *Incredible Toddlers: A Guide and Journal of Your Toddler's Discoveries* book or *The Incredible Years: A Troubleshooting Guide for Parents of Children Aged 3-8 Years (3rd Edition)* book was an optional assignment. Group leaders contacted or attempted to contact parents individually on a weekly basis for check-in phone calls. Attendance in the group sessions was recorded by each group leader. The group sessions included the same core components each week and followed a consistent structure as outlined in the Leader's Manual. *The Incredible Years* model follows several core principles in its approach to treatment: using home activities, video vignettes, social support, and close collaboration. The core program principles and objectives are outlined in (Appendix A).

When learning new skills, parents were shown video vignettes of real parents and their children with ASD, which provided exemplar models of skills applications in the home setting.

Sessions began with parents reporting on their home activities from the prior week and sharing successes or challenges. The leaders encouraged discussion to address questions and concerns. Leaders then introduced additional parenting strategies related to the module. Parents were encouraged to ask questions and apply strategies to their own children. Videos were paused frequently for discussion, commentary, and self-reflection. As parents learned new skills, they were prompted to brainstorm ideas as a group, complete exercises and worksheets, pair up for partner discussions, and write "scripts" for how they will apply the skill when playing with their child. Parents then engaged in role-playing activities, to practice with each other and gain feedback on their skill acquisition. At the end of every weekly session, parents received handouts with tips for implementing the skills and prompts for applying the skills in play sessions at home.

The IY-ASLD® program, begins with the foundational strategies to increase responsive parenting skills and build positive parent-child relationships. There were eight modules covered in the program: (1) Child-Directed Narrated Play Promotes Positive Relationships; (2) Pre-Academic and Persistence Coaching Promotes Language Development and School Readiness; (3) Social Coaching Promotes Friendship Skills; (4) Emotion Coaching Promotes Emotional Literacy; (5) Pretend Play Promotes Empathy and Social Skills; (6) Promoting Children's Self-Regulation Skills; (7) Using Praise and Rewards to Motivate Children; (8) Limit-Setting and Behavior Management. Compared to the IY-BASIC®, the IY-ASLD® program has an increased focus on methods for using play activities to build language, empathy, social skills, and behavioral-regulation. Due to the communication difficulties of children with ASD, parents learn to assess their child's language levels and use reinforcing and developmentally appropriate ways to promote social communication. The program emphasizes a functional approach to behavior

change, where parents learn the "ABCs" of behavior, by identifying (A) the antecedent that proceeds a behavior, (B) the behavior itself, and (C) the consequences that maintain it. Parents learn ways to shape antecedents and reinforcing consequences to promote appropriate and/or desired behaviors. To get into their child's "attention spotlight" parents leverage their child's play interests and sensory needs using narration, imitation, and praise, as means of establishing joint attention and shared enjoyment in play. Refer to (Appendix A) for a list of IY-ASLD® core objectives.

Training and Supervision. All four of the clinician group leaders attended a 5-day training for the IY-ASLD® program in January 2021. Three of the four group leaders were advanced doctoral students in the Teachers College School Psychology Program, and one was an advanced doctoral student in the Teachers College Applied Behavior Analysis Program. All clinicians had previous experience working with young children with ASD and had prior training in behavioral interventions. During the intervention, all leaders followed the manual for structuring sessions, and assigning home activities. Sessions were videotaped and then segments of the videos were reviewed during biweekly supervision sessions with the program developer, Dr. Carolyn Webster-Stratton. Supervision took place with Dr. Webster-Stratton for one hour on a bi-weekly basis for a total of seven supervision sessions. All group leaders were present for supervision sessions. Group leaders took turns showing video segments from their group sessions, completed goals and written reflections on their delivery of the program, and brought specific questions to the supervisor. The supervision group watched video segments of each other's sessions and brainstormed different approaches to resolve questions.

Parent Child Interaction Procedure

The parent-child interaction (PCI) assessment sessions consisted of two experimental tasks that occurred across a 10-min period: 1) structured-play task (5-min duration), and 2) free-play task (5-min duration). The PCI assessment sessions occurred virtually via ZOOM healthcare and were recorded in real time at three different occasions 1) pre-intervention, 2) mid-intervention, and 3) post intervention. At the conclusion of each session, video recordings of the sessions were saved to a virtual desktop and uploaded directly to a file in the lab shared drive labeled with each participant's unique 5-digit number. Data from these sessions were not recorded at the time of the PCI assessments, but rather later by viewing the video recordings.

Once the date and time for the PCI session was scheduled and prior to the beginning of the session, the experimenter sent each participant brief instructions to help them prepare the materials and set up the environment. Each session began with the experimenter introducing themselves and reminding the participant to remain within the camera frame with her child throughout the session. The experimenter also asked the parent participant to clear out the room from other distractions, adjust lighting and laptop/tablet camera positioning if needed, and to keep all the materials off to one side. Please refer to (Appendix C) for a copy of the script used during these sessions.

Structured-play task. For first task in the PCI, the experimenter asked the Participant to bring crayons or markers as well as sheets of plain paper and to teach their child to do a drawing at their level. The experimenter then turned off their camera and started the 5-min timer. Once the timer went off, the experimenter turned their camera back on and congratulated the child on completing the task.

Free-play task. For the second task, the experimenter asked the parent participant to bring to the table a variety of toys that the child preferred and to place them in front of him. The experimenter instructed the parent to play with their child once the 5-min timer was set and the experimenter's camera was turned off. After five minutes of the unstructured-play task, the experimenter turned their camera back on and praised the mother and the child for finishing the task.

Date Collection Procedure

Process to Collect Measures of Verbal Behaviors

Data from the PCI sessions were collected using event recordings across the emission of verbal responses between the parent and the child. Following the completion of the PCI sessions, the data collection process included a calibration phase, transcription phase, and a coding phase. Refer to (Appendix D) for a list of guidelines used during the transcription phase, and (Appendix E) for a list of guidelines used during the coding phase.

Transcription Phase. First, the researchers identified the beginning and end time of each one of the two tasks (i.e., structured-activity task, and free-play task). After this, researchers transcribed the mother and child verbal behaviors used in the video. Verbal behaviors included both vocal behaviors and non-vocal behaviors demonstrating clear communicative intent (e.g., head nod, head shake, action matching the previous vocal verbal behavior such as following a direction). For each line of transcription, the coder identified a) the relevant communicator (mom or child) and b) either a transcription of the vocal verbal language or a description of the non-vocal action. Researchers continued to type in the same line of the transcript until either a) the speaker switched to the other person (e.g., mom was communicating and now child began

communicating), b) one of the participants demonstrated a clear listener behavior, or c) 3s had passed between the end of the previous communication and the start of a new one. We defined clear listener behaviors as observing responses which were directly relevant to previous vocal verbal behaviors. Examples included turning one's gaze to an object being discussed or to the speaker, complying with a direction, or clear non-compliance with a direction (e.g., when asked to pick up a crayon, pushing the crayon away). When any of these criteria for the end of a transcription line were met, the coder began a new line of the transcript. To verify the transcriptions, researchers flagged all instances in the video segments where they were not confident in their responses to be reviewed by the BCBA supervisors and a faculty member.

Vocal Verbal Operant Coding Phase. After transcription was complete, researchers counted the number of vocal verbal operants (VVOs) in each line of transcription. VVOs included mands, tacts, approvals, and disapprovals. Researchers counted mands and tacts emitted by both mother and child, while they only counted approvals and disapprovals emitted by the mother.

Response Type Coding Phase. We categorized each response based on its form into one of three categories: a) speaker response; b) listener response; or c) no response (NR). Speaker responses included vocal verbal behavior (VB), non-lexical vocal verbal behavior (NL), or non-vocal verbal behavior (NV).

After transcription and counting the VVOs were completed, researchers went back to the beginning of the video to code the type of response which followed each line of transcription. For each line of transcription, they identified the type of verbal behavior which occurred immediately following. Most often, this was identified via the transcript (e.g., following the

mother's vocal verbal behavior, the child emitted vocal verbal behavior). However, if no response was emitted within 3 seconds of a transcription line, researchers identified the response type as "no response" (NR). Thus, researchers watched the video again while coding the reinforcement type to ensure they did not miss instances of no response.

Experimental Design

A pretest-posttest quasi-experimental design (Cook & Campbell, 1979) was used in this pilot study to explore the patterns, relationships, and associations of the IY-ASLD® on the dependent variables measured at three time points: Pre-intervention (Time 1); Mid-intervention (Time 2); and Post- intervention (Time 3). A quasi-experimental design is a research design that shares some similarities with experimental designs but lacks full the presence of a control group. Quasi-experimental research involves the manipulation of an independent variable without the random assignment of participants to conditions or orders of conditions.

Interobserver Agreement

Coding was completed by trained research assistants (secondary researchers) unaware of the research hypothesis. In the first phase, the secondary researchers were trained to measuring target responses by following written guidelines containing definitions and examples of each response (See Appendix E). The secondary researchers practiced coding independently until they were calibrated with the primary coder; reached an agreement level of 80% or higher with the primary coder. Once they met the predetermined criterion, they coded new videos independently.

Interobserver agreement (IOA) was collected for the parent-child interaction sessions in which the secondary researchers independently watched the videos and recorded the mother and the child's responses. Once the secondary researchers finished collecting data, point-to-point agreement was calculated for each corresponding behavior by dividing the number of responses in agreement by the number of agreements and disagreement and multiplying by 100. IOA was collected on 35% of the structured-play and the free-play tasks of parent-child interaction sessions with an overall agreement of 91% and a range of 88% - 97%.

Chapter 3: Results

Q1. Effects of IY-ASLD® on the Quantity of Mother-Child Interactions

The first research question tested the effects of the IY-ASLD® intervention on the quantity of mother-child interactions, as measured by the number of verbal operants emitted by the mothers (i.e., mands and tacts), and the number of approvals vs. disapprovals. Based on the previously mentioned content objectives that are directly taught to parents in the IY-ASLD®, we hypothesized that there will be an increase in the number of tacts and approvals emitted by the mothers, and a decrease in the number of mands and disapprovals.

1a. Quantities of Mothers' Tacts.

Structured-Play Task. The results of the Friedman test indicated that there was not a significant difference between the number of mothers' (n = 16) **tacts** emitted during the *structured-play* task across the three conditions (pre-intervention, mid-intervention, post-intervention), $F_{r\,(2)} = 3.1$, $p = .212$. The effect size was small, with a Cohen's d of 0.33. The Wilcoxon signed-rank test showed that compared to pre-intervention (T1; $M = 35.18$, $SD = 14.16$), the number of tacts initiated by the mothers did not increase significantly at mid-intervention (T2; $M = 29.75$, $SD = 14.66$), $Z = -1.85$, $p = .064$, nor post-intervention (T3; $M = 30.47$, $SD = 13.47$), $Z = -1.24$, $p = .214$. Similarly, the number of tacts initiated by the mothers during the *structured-play task* did not increase significantly from mid-intervention (T2) to post-intervention (T3), $Z = -.28$, $p = .77$. Refer to (Figure 1).

Free-Play Task. Number of tacts emitted in the free-play task were normally distributed, therefore, a parametric analysis was conducted. When examining the *free play* task, a repeated measures ANOVA with a Greenhouse-Geisser correction determined that there was not a

statistically significant difference in mean number of tacts emitted by the mothers between time points F= (1.5, 22.2) = 2.72, p=1. Since the overall ANOVA result was not significant, the Pairwise Comparisons table was not examined. Based on the small sample size (n =16), a non-parametric analysis was also conducted. The results of the Friedman test indicated that there was a significant difference between the number of mothers' (n = 16) **tacts** emitted across the three conditions (pre-intervention, mid-intervention, post-intervention), $F_{r\,(2)} = 6.13$, $p = .047$. The effect size was small, with a Cohen's d of -0.47. The Wilcoxon signed-rank test showed that the number of tacts initiated by the mothers did not increase significantly from pre-intervention (T1; $M = 29.24$, $SD = 12.57$) to mid-intervention (T2; $M = 30.19$, $SD = 13.73$), $Z = -.18$, $p = .85$. However, the Wilcoxon signed-rank test showed that the number of tacts initiated by the mothers during the *free-play* task increased significantly from pre-intervention (T1) to post-intervention (T3; $M = 35.24$, $SD = 12.37$), $Z = -2.06$, $p = .03$, and from mid-intervention (T2) to post-intervention (T3), $Z = -2.14$, $p = .032$. Refer to (Figure 1).

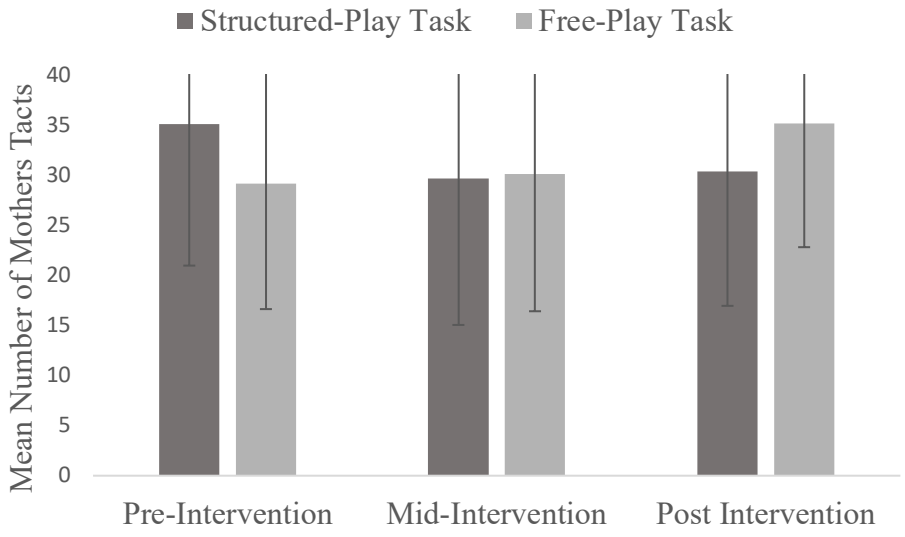

Figure 1. Mean number of tacts emitted by the mothers across the two tasks.

1b. Quantities of Mothers' Mands

Structured-Play Task. When examining the *structured-play* task, the results of the Friedman test indicated that there was not a significant difference between the number of mothers' (n = 16) **mands** emitted across the three conditions (pre-intervention, mid-intervention, post-intervention), $F_{r\,(2)} = 0.5$, $p = .779$. The effect size was small, with a Cohen's *d* of -.03. The Wilcoxon signed-rank test showed that compared to pre-intervention (T1; $M = 62$, $SD = 24$), the number of mands initiated by the mothers during *structured-play* task did not change significantly at mid-intervention (T2; $M = 67.5$, $SD = 21.42$), $Z = -1.29$, $p = 0.19$, nor post-intervention (T3; $M = 63$, $SD = 25.5$), $Z = -.37$, $p = .7$. The number of mands initiated by the mothers during the structured-play task also did not change significantly from mid-intervention (T2) to post-intervention (T3), $Z = -.95$, $p = .33$. Refer to (Figure 2).

Free-Play Task. Number of mands emitted in the play-task were normally distributed, therefore, a parametric analysis was conducted. A repeated measures ANOVA with a Greenhouse-Geisser correction determined that there was not a statistically significant difference in mean number of mands emitted by the mothers between time points, F=(1.29, 19.4) = .49, p=.541. Since the overall ANOVA result was not significant, the Pairwise Comparisons table was not examined. Based on the small sample size (n =16), a non-parametric analysis was also conducted. When examining the *free play* task, the results of the Friedman test indicated that there was not a significant difference between the number of mothers' (n = 16) **mands** emitted across the three conditions (pre-intervention, mid-intervention, post-intervention), $F_{r\,(2)} = .023$, $p = .893$. The effect size was small, with a Cohen's *d* of .04. The Wilcoxon signed-rank test showed that compared to pre-intervention (T1; $M = 58.88$, $SD = 25.56$), the number of mands

initiated by the mothers did not change significantly at mid-intervention (T2; $M = 54.88$, $SD = 18.9$), $Z = -.79$, $p = .42$, nor post-intervention (T3; $M = 57.8$, $SD = 25.5$), $Z = .23$, $p = .8$. The number of mands initiated by the mothers during the structured-play task also did not change significantly from mid-intervention (T2) to post-intervention (T3), $Z = -.48$, $p = .62$. Refer to (Figure 2).

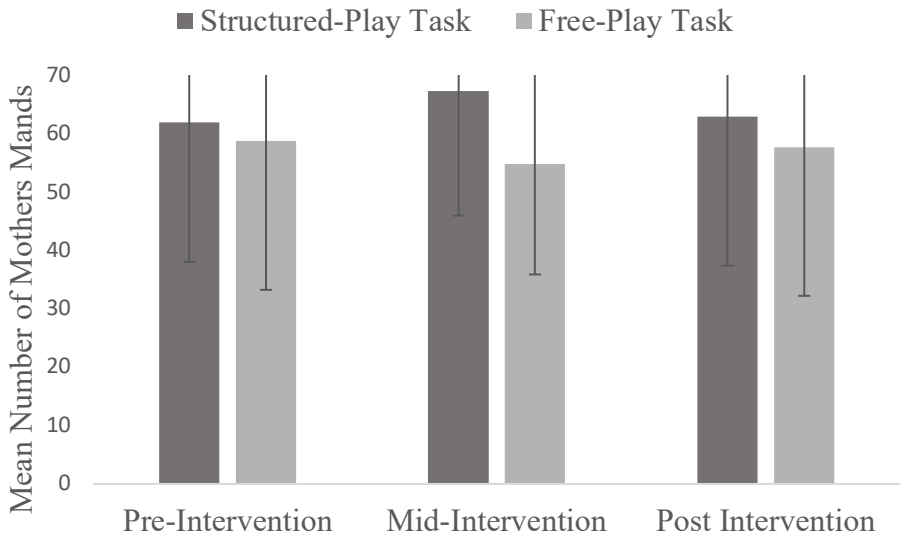

Figure 2. Mean number of mands emitted by the mothers across the two tasks

1c. Quantities of Mothers' Approvals

Structured-Play Task. Number of approvals emitted in the structure-play task were normally distributed, therefore, a parametric analysis was conducted. A repeated measures ANOVA with a Greenhouse-Geisser correction determined that there was not a statistically significant difference in mean number of verbal operants emitted by the mother approval between time points $F = (1.5, 22.3) = 0.61$, $p = .503$. Since the overall ANOVA result was not significant, the Pairwise Comparisons table was not examined. Based on the small sample size (n

=16), a non-parametric analysis was also conducted. When examining the *structured-play* task, the results of the Friedman test indicated that there was not a significant difference between the number of mothers' (n = 16) **approvals** emitted across the three conditions (pre-intervention, mid-intervention, post-intervention), $F_{r\,(2)} = 1.16$, $p = .56$. The effect size was small, with a Cohen's *d* of .11. The Wilcoxon signed-rank test showed that compared to pre-intervention (T1; $M = 13.41$, $SD = 8.3$), the number of approvals initiated by the mothers during *structured-play task* did not increase significantly at mid-intervention (T2; $M = 15.06$, $SD = 7.57$), $Z = -.078$, $p = .93$, nor post-intervention (T3; $M = 12.47$, $SD = 8.63$), $Z = -.28$, $p = .77$. Similarly, the Wilcoxon signed-rank test showed that the number of approvals initiated by the mothers during the *structured-play task* did not change significantly from mid-intervention (T2) to post-intervention (T3), $Z = -1.47$, $p = .14$. Refer to (Figure 3).

Free-Play Task. However, when examining the *free play* task, the results of the Friedman test indicated that there was a statistically significant difference between the number of mothers' (n = 16) **approvals** emitted across the three conditions (pre-intervention, mid-intervention, post-intervention), $F_{r\,(2)} = 7.42$, $p = .024$. The effect size was small, with a Cohen's *d* of .49. Similarly, the Wilcoxon signed-rank test showed that the number approvals emitted **by** the mothers decreased significantly from pre-intervention (T1; $M = 16.18$, $SD = 9$) to mid-intervention (T2; $M = 8.5$, $SD = 6.4$), $Z = -2.82$, $p = .005$. Yet, it did not change significantly from T1 to post-intervention (T3; $M = 11.71$, $SD = 11.79$), $Z = -1.65$, $p = .09$. The Wilcoxon signed-rank test showed that the number of approvals emitted by the mothers did not change significantly from mid-intervention (T2) to post-intervention (T3), $Z = -1.17$, $p = .23$. Refer to (Figure 3).

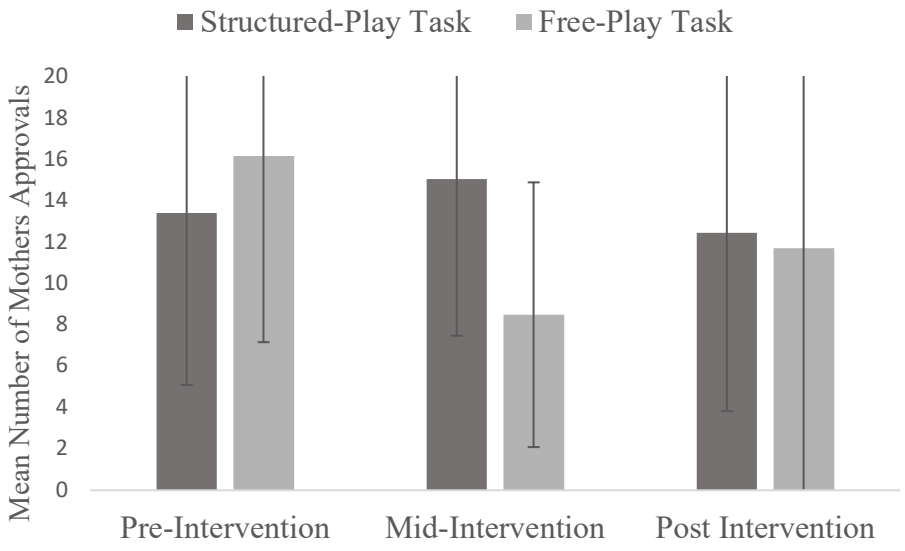

Figure 3. Mean number of approvals emitted by the mothers across the two tasks.

1d. Quantities of Mothers' Disapprovals

Structured-Play Task. When examining the *structured-play* task, the results of the Friedman test indicated that there was not a significant difference between the number of mothers' (n = 16) **disapprovals** emitted across the three conditions (pre-intervention, mid-intervention, post-intervention), $F_{r\,(2)} = 1.13$, $p = .57$. The effect size was small, with a Cohen's *d* of -.11. The Wilcoxon signed-rank test showed that the number of disapprovals initiated by the mothers during the *structured-play task* did not change significantly from pre-intervention (T1; $M = 1.35$, $SD = 2.18$) to mid-intervention (T2; $M = .94$, $SD = 1.84$), $Z = -.77$, $p = .43$, nor post-intervention (T3; $M = 1.59$, $SD = 3.06$), $Z = -.28$, $p = .77$. Similarly, the number of disapprovals initiated by the mothers in the *free-play* task did not change significantly from mid-intervention (T2) to post-intervention (T3), $Z = -1.02$, $p = .3$. Refer to (Figure 4).

Free-Play Task. When examining the *free play* task, the results of the Friedman test indicated that there was not a significant difference between the number of mothers' (n = 16) **disapprovals** emitted across the three conditions (pre-intervention, mid-intervention, post-intervention), $F_{r\,(2)} = 2.12$, $p = .347$. The effect size was small, with a Cohen's d of .2. The Wilcoxon signed-rank test showed that the number of disapprovals initiated by the mothers did not change significantly from pre-intervention (T1; $M = 1.35$, $SD = 2.42$) to mid-intervention (T2; $M = .44$, $SD = .72$), $Z = -1.46$, $p = .14$, nor post-intervention (T3; $M = .88$, $SD = 1.45$), $Z = -1.02$, $p = .3$. Similarly, the number of disapprovals initiated by the mothers during both tasks did not change significantly from mid-intervention (T2) to post-intervention (T3), $Z = -1.59$, $p = .11$. Refer to (Figure 4).

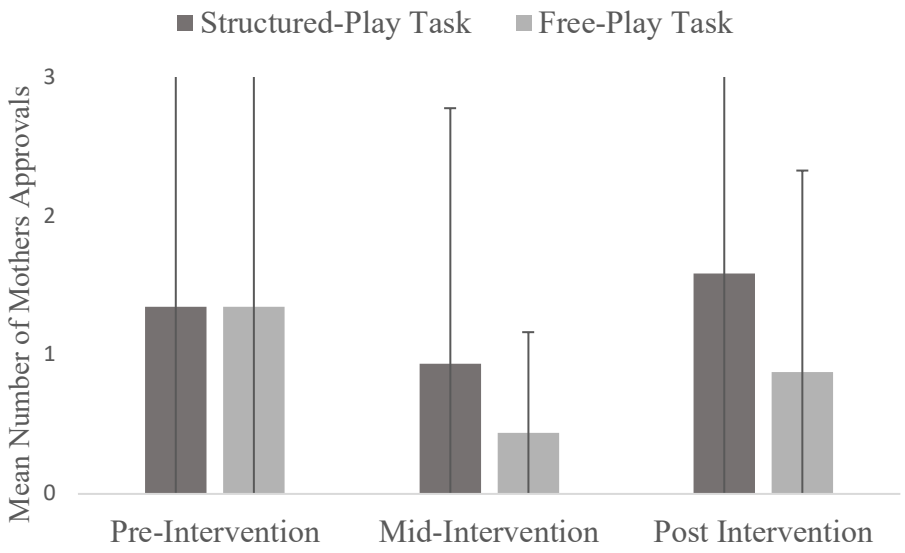

Figure 4. Mean number of disapprovals emitted by the mothers across the two tasks.

Q2. Effects of the IY-ASLD® on the Quality of Mother-Child Interactions

The first research question tested the effects of the IY-ASLD® intervention on the *quality* of mother-child interactions as measured by the number of children's responses to mothers' initiations, and the number of mothers' responses to children's initiations. We hypothesized that there would be an increase in mothers' verbal responsiveness to their children's initiations, and mothers' effectiveness in eliciting a response from their children, and a decrease in the number of missed opportunities for mothers and children (i.e., no responses).

2a. Mothers' Responsiveness *to Children's Initiations*

To determine if the mothers were more responsive to their children, the effects of the IY-ASLD® intervention on the number of mothers' responses to children's initiations (i.e., mothers' responses) were measured. Figure 5 provides a visual display of the mean number of mothers' responses to child's initiations (i.e., mothers' responses) during both tasks.

Structured-Play Task. When examining the *structured-play* task the results of the Friedman test indicated that there was not a significant difference between the number of **mothers' responses** to child's initiations emitted across the three conditions (pre-intervention, mid-intervention, post-intervention), $F_{r\,(2)} = 1$, $p = .607$. The effect size was small, with a Cohen's *d* of .05. Using the Wilcoxon signed-rank test, compared to pre-intervention (T1; $M = 4.67$, $SD = 6.46$), the number of mothers' responses to children's initiations (i.e., mothers' responses) during the *structured-play* task did not increase significantly at mid-intervention (T2; $M = 8.09$, $SD = 15.01$), $Z = -.78$, $p = .43$, nor post-intervention (T3, $M = 4.29$ $SD = 7.6$), $Z = -.114$, $p = .91$. Similarly, the Wilcoxon signed-rank test showed that the number of mothers'

responses during the *structured-play task*s at mid-intervention (T2) did not increase significantly at post-intervention (T3), Z = -.094, p = .92. Refer to (Figure 5).

Free-Play Task. When examining the *free play* task, the results of the Friedman test indicated that there was not a significant difference between the number of **mothers' responses** to children's initiations emitted across the three conditions (pre-intervention, mid-intervention, post-intervention), $F_{r\,(2)}$ = 1.08, p = .584. The effect size was small, with a Cohen's d of -.3. When examining the *free play* task using the Wilcoxon signed-rank test, the number of mothers' responses to child's initiations did not increase significantly from pre-intervention (T1; M = 2.84, SD = 1.78) to mid-intervention (T2; M = 6.04, SD =11.25), Z = -.22, p = .82 , nor post-intervention (T3; M = 3.34, SD = 3.39), Z = -.65, p = .51. Similarly, the Wilcoxon signed-rank test showed that the number of mothers' responses during the *free play* task did not increase significantly from mid-intervention (T2) to post-intervention (T3), Z = -.52, p = .6. Refer to (Figure 5).

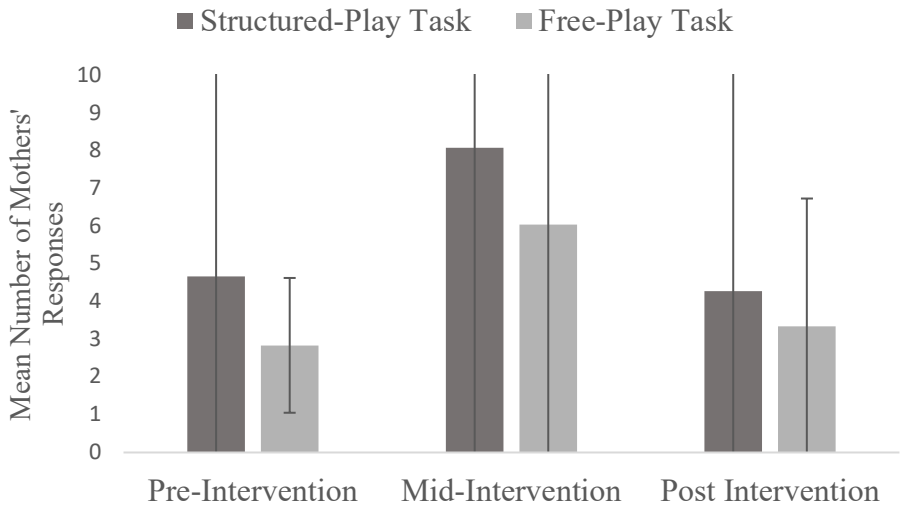

Figure 5. Mean number of mothers' responses to children's initiations (i.e., mothers' responses) across the two tasks

2b. Children's Responses to Mothers' Initiations

To determine if the mothers were effective in eliciting a response from their children, the effects of the IY-ASLD® intervention on the number of children's responses to mothers' initiations (i.e., children's responses) were measured. Figure 6 provides a visual display of the mean number of mothers' responses that were responded to by the children (i.e., child's responses) during both tasks.

Structured-Play Task. When examining the *structured-play task*, the results of the Friedman test indicated that there was not a significant difference between the number of **children's responses** to mothers' initiations emitted across the three conditions (pre-intervention, mid-intervention, post-intervention), $F_{r\,(2)} = 2.38$, $p = .305$. The effect size was small, with a Cohen's *d* of .13. Using the Wilcoxon signed-rank test, compared to pre-intervention (T1; $M = .44$, $SD = .18$), the number of child's responses to mothers' initiations during the *structured-play task* did not increase significantly at mid-intervention (T2; $M = .42$, $SD = .12$), $Z = -.155$, $p = .877$, nor post-intervention (T3, $M = .41$, $SD = .12$), $Z = -.734$, $p = .463$. Similarly, the Wilcoxon signed-rank test showed that the number of child's responses during the *structured-play task*s at mid-intervention (T2) did not increase significantly at post-intervention (T3), $Z = -.517$, $p = .605$. Refer to (Figure 6).

Free-Play Task. However, when examining the *free play* task, the results of the Friedman test indicated that there was a significant difference between the number of **children's responses** to mothers' initiations emitted across the three conditions (pre-intervention, mid-intervention, post-intervention), $F_{r\,(2)} = 9.5$, $p = .009$. The effect size was medium, with a Cohen's *d* of .5. The Wilcoxon signed-rank test showed that the number of child's responses to

mothers' initiations did not increase significantly from pre-intervention (T1; *M* = .5119, *SD* = .196) to mid-intervention (T2; *M* = .493, *SD* = .158), *Z* = -.259, *p* = .796. However, the Wilcoxon signed-rank test showed that the number of children's responses during the *free play* task decreased significantly from pre-intervention (T1) to post-intervention (T3; *M* = .412, *SD* = .184), *Z* =-2.627, *p* = .009, and from mid-intervention (T2) to post-intervention (T3), *Z* =-2.275, *p* = .023. Refer to (Figure 6).

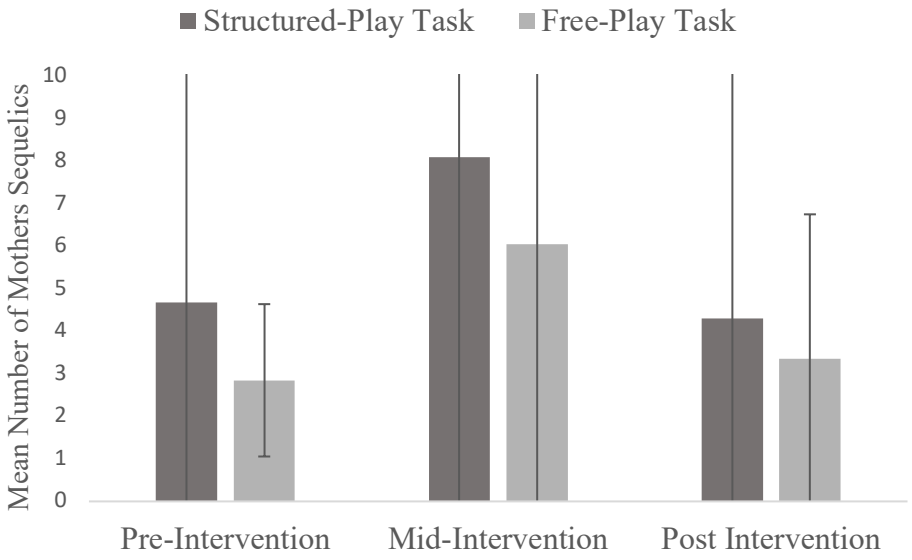

Figure 6. Mean number of children's responses to mothers' initiations (i.e., child's responses) across the two tasks.

2c. Mothers' Missed Opportunities

To determine the effects of the IY-ASLD® intervention on the number of missed opportunities for the mothers, the effects of the intervention on the number of mothers' no responses (NR) to child's initiations. Figure 7 provides a visual display of the mean number of mothers' no responses (NR) to child's initiations.

Structured-Play Task. When examining the *structured-play* task, the results of the Friedman test indicated that there was a significant difference between the number of **mothers' missed opportunities** (i.e., no responses) across the three conditions (pre-intervention, mid-intervention, post-intervention), $F_{r\,(2)} = 5.89$, $p = .053$. The effect size was small, with a Cohen's d of .32. The Wilcoxon signed-rank test showed that the number of mothers' no responses decreased significantly from pre-intervention (T1; $M = 3.64$, $SD = 10.28$) to mid-intervention (T2; $M = .38$, $SD = .619$), $Z = -2.14$, $p = .032$, and from T1 to post-intervention (T3; $M = .29$, $SD = .47$), $Z = -2.14$, $p = .032$. However, the Wilcoxon signed-rank test showed that the number of mothers' no responses did not change significantly from mid-intervention (T2) to post-intervention (T3), $Z = -.44$, $p = .65$. Refer to (Figure 7).

Free-Play Task. When examining the *free play* task, the results of the Friedman test indicated that there was a significant difference between the number of **mothers' missed opportunities** (i.e., no responses) across the three conditions (pre-intervention, mid-intervention, post-intervention), $F_{r\,(2)} = 6.41$, $p = .041$. The effect size was small, with a Cohen's d of .45. The Wilcoxon signed-rank test showed that the number of mothers' no responses decreased significantly from pre-intervention (T1; $M = .76$, $SD = 1.03$) to mid-intervention (T2; $M = .31$, $SD = .602$), $Z = -2.12$, $p = .033$. However, it did not change significantly from T1 to post-intervention (T3; $M = .29$, $SD = .58$), $Z = -1.62$, $p = .103$. The Wilcoxon signed-rank test showed that the number of mothers' no responses did not change significantly from mid-intervention (T2) to post-intervention (T3), $Z = .000$, $p = 1$. Refer to (Figure 7).

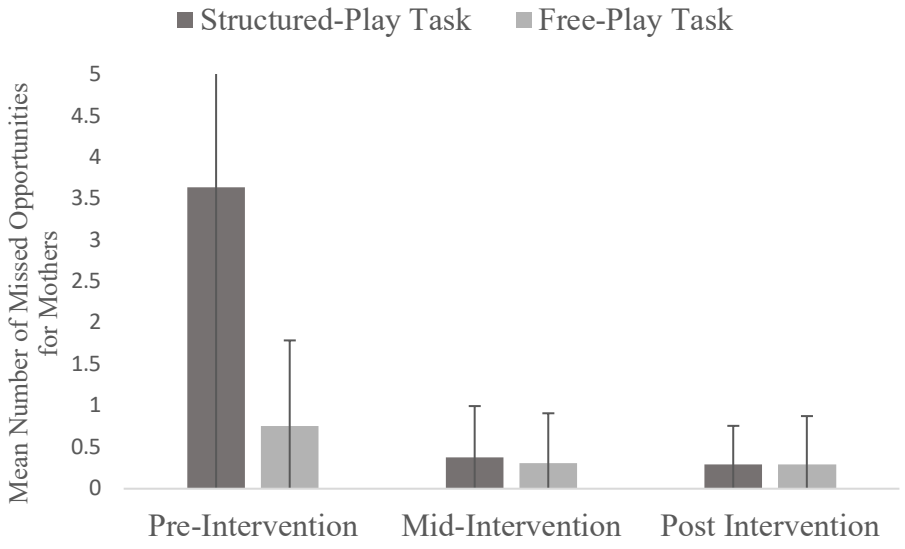

Figure 7. Mean number of mothers' no responses (NR) to children's initiations across the two tasks

2d. Children's Missed Opportunities

To determine the effects of the IY-ASLD® intervention on the number of missed opportunities for the children, the effects of the intervention on the number of child's no responses (NR) to mothers' initiations were measured. Figure 8 provides a visual display of the mean number of children's no responses (NR) to mothers' initiations.

Structured-Play Task. When examining the *structured-play* task, the results of the Friedman test indicated that there was a significant difference between the number of **children's missed opportunities** (i.e., no responses) across the three conditions (pre-intervention, mid-intervention, post-intervention), $F_{r\,(2)} = 6.82$, $p = .033$. The effect size was medium, with a Cohen's d of .6. The Wilcoxon signed-rank test showed that the number of children's no responses to mothers' initiations at the *structured-play* task did not change significantly from pre-intervention (T1; $M = 8.88$, $SD = 8.108$) to mid-intervention (T2; $M = 6.13$, $SD = 6.73$), $Z = -1.9$, $p = .056$. However, it

did decrease significantly from T1 to post-intervention (T3; M = 3.88, SD =3.18), Z = -2.66, p = .008. The number of children's no responses did not change significantly from mid-intervention (T2) to post-intervention (T3), Z = -.88, p = .374. Refer to (Figure 8).

Free-Play Task. When examining the *free play* task, the results of the Friedman test indicated that there was not a significant difference between the number of **children's missed opportunities** (i.e., no responses) across the three conditions (pre-intervention, mid-intervention, post-intervention), $F_{r\,(2)}$ = 1.76, p = .414. The effect size was small, with a Cohen's d of .2. The Wilcoxon signed-rank test showed that the number of children's no responses to mothers' initiations did not decrease significantly from pre-intervention (T1; M = 7.29, SD = 6.44) to mid-intervention (T2; M = 5.81, SD = 4.9), Z = -1.68, p = .092, nor post-intervention (T3; M = 6, SD = 5.03), Z = -.67, p = .5. Similarly, the Wilcoxon signed-rank test showed that the number of children's no responses during the *free play* task did not decrease significantly from mid-intervention (T2) to post-intervention (T3), Z = -.31, p = .75. Refer to (Figure 8).

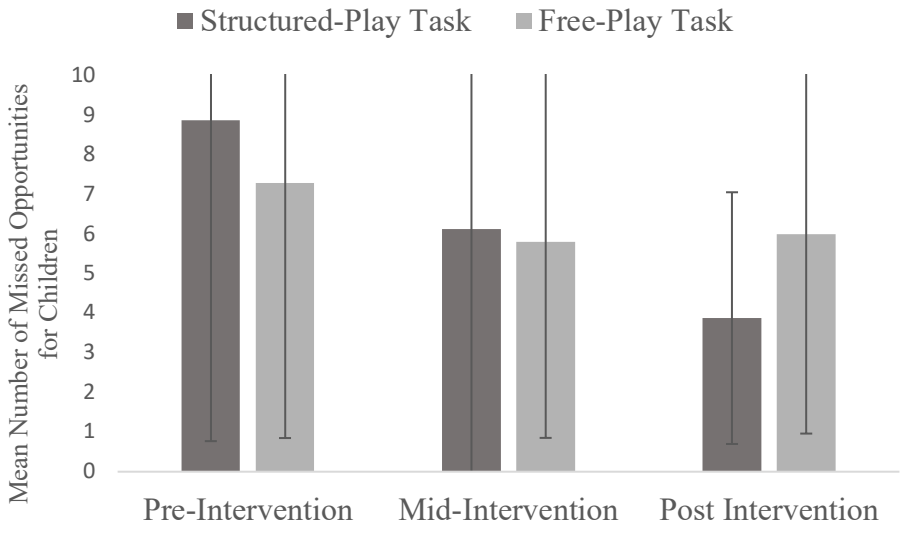

Figure 8. Mean number of children's no responses to mothers' initiations across the two tasks

Q3. Correlations Between Parental Stress and the Quality and Quantity of Mother-Child Interactions

The third question examined the correlation between parental stress, as measured by mothers' Parenting-Stress Index (PSI-4), and the quality and quantity of parent-child interactions as measured by the number of mothers' responses to children's initiations (i.e., mothers' responses) and the number of tacts, approvals, and disapprovals emitted by the mothers during the structured-play task, and the free-play task. Given that the study variables were not normally distributed, nonparametric correlation tests were used in the following analyses. Refer to (Table 2) for the correlation coefficients between parenting stress and the other variables at baseline, and (Table 3) at post-intervention.

3a. Parental Stress and the Quality of Mother-Child Interactions

To determine the association between mothers' stress level with how responsive they were to their children, the correlation between parental stress and the number of child-initiated responses that were reinforced by the mothers (i.e., mothers' responses) were measured.

Pre-Intervention. At the pre-intervention (T1) phase, the Spearman correlation test showed that mothers' stress levels, as measured by the PSI-4 total score, were moderately negatively associated with the number of **mothers' responses** to children's initiations at both, the structured-play task, r_s (17) = -.58, p = .024, and at free-play task, r_s (17) = -.51, p = .042 , such that those with higher stress level at T1 had responded to significantly less child initiations in both structured-play and free play tasks.

Post-Intervention. However, at the post-intervention (T3) phase, the Spearman correlation test showed that there was no significant association between mothers' stress level

and the number of children's initiation that were responded to by the mothers (mothers' responses) at the structured-play task, r_s (17) = -.45, p = .08, nor at the free-play task, r_s (17) = -.32, p =.270.

3b. Parental Stress and the Quantity of Mothers' Tacts

To determine the association between mothers' stress level and their use of descriptive language, the correlation between parental stress and the number of *tacts* emitted by the mothers during the structured-play task, and the free-play task were measured before and after the intervention.

Pre-Intervention. The Spearman correlation test showed that there was no significant association between mothers' stress level at T1, as measured by the PSI-4 total score and how much they spoke to their children based on the total number of mothers' **tacts** at the *structured-play task* at T1, r_s (17) = -.14, p = .598, nor at the *free-play task* at T1, r_s (17) = -.08, p = .750.

Post-Intervention. Similarly, there were no significant associations between mothers' stress level at T3 and the total number of mothers' **tacts** at the *structured-play task* T3, r_s (17) = -.17, p = .521, nor at the *free-play task* at T3, r_s (17) = .17, p = .515. Indicating that mothers' stress levels were also not associated with how much they spoke to their children after the intervention.

3c. Parental Stress and the Quantity of Mothers' Mands

To determine the association between mothers' stress level and their use of more controlling language, the correlation between parental stress and the number of *mands* emitted by the mothers during the structured-play task, and the free-play task were measured before and after the intervention.

Pre-Intervention. The Spearman correlation test showed that there was no significant association between mothers' stress level, as measured by the PSI-4 total score and the total number of mothers' **mands** emitted in *structured-play task* at T1, r_s (17) = -.13, p = .622. However, mothers' stress levels were moderately negatively associated with the number of mands emitted by the mothers at the *free-play task* at T1, r_s (17) = -.57, p = .018. Indicating that mothers with higher stress levels emitted significantly fewer mands during the free-play task at the pre-intervention.

Post-Intervention. During the post-intervention (T3), mothers' stress levels were moderately negatively associated with the number of **mands** emitted by the mothers at both, the *structured-play task*, r_s (17) = -.49, p = .045, and at the *free-play task*, r_s (17) = -.7, p <.001, such that those with higher stress levels at T3 had emitted significantly fewer mands in both structured-play and free-play tasks.

3d. Parental Stress and the Quantities of Mothers' Approvals

To determine the association between mothers' stress level and their use of positive language, the correlation between parental stress and the number of *approvals* emitted by the mothers during the structured-play task, and the free-play task were measured before and after the intervention.

Pre-Intervention. Mothers' stress level, as measured by the PSI-4 total score, was not significantly associated with the total number of mothers' **approvals** emitted during the *structured-play task* r_s (17) = .23, p = .367, nor at the *free-play task* r_s (17) = -.208, p = .423, based on the Spearman correlation test.

Post-Intervention. Similarly, at the post-intervention (T3), no significant associations were found between mothers' stress level and the total number of mothers' approvals emitted during the structured-play task at T3, r_s (17) = .21, p = .413, nor at the free-play task r_s (17) = .2, p = .439, based on the Spearman correlation test.

3e. Parental Stress and the Quantities of Mothers' Disapprovals

To determine the association between mothers' stress level and their use of negative language, the correlation between parental stress and the number of *disapprovals* emitted by the mothers during the structured-play task, and the free-play task were measured before and after the intervention.

Pre-Intervention. Mothers' stress level, as measured by the PSI-4 total score, was not significantly associated with the total number of mothers' ***disapprovals*** emitted during the *structured-play task* r_s (17) = -.11, p = .662, nor at the *free-play task* r_s (17) = -.004, p =.988, based on the Spearman correlation test.

Post-Intervention. No significant associations were found between mothers' stress level and the total number of mothers' disapprovals emitted during the *structured-play task* at T1, r_s (17) = -.272, p = .29, nor at the *free-play task* r_s (17) = -.32, p = .217, based on the Spearman correlation test.

Chapter 4: Discussion

Using a verbal behavioral approach, we aimed to investigate the effect size and the statistical significance of changes in the quality and quantity of parent-child interactions, after the mothers participated in a virtual parent training program, by measuring the number of verbal operants exchanged between the dyads during two naturalistic mother-child interaction tasks, at baseline, during, and after the intervention. We also investigated the relation between parental stress, as measured by self-reported parental stress levels at baseline and after the intervention using the PSI-SF-4 (Abidin, 2012) scores, and the quality and quantity of parent-child interactions.

Overall, when looking at the quantities of mothers' verbal operants, the results demonstrated that there was a statistically significant increase in the number of tacts emitted by the mothers in the free-play task, as well as a statistically significant decrease in the number of approvals following the intervention, albeit both had a small effect size. There were no statistically significant changes in the number of mothers' mands or disapprovals. When looking at the changes in the quality of mother-child interactions after the intervention, the findings showed statistically significant decreases in the number of missed opportunities for the children during the structured-play task, with a medium effect size, and in the number of missed opportunities for the mothers in both tasks. There were no statistically significant changes in mothers' responsiveness to their children's initiations. The results also show a statistically significant decrease in children's responses to mothers' initiations in the free-play task. Furthermore, this study also aimed to assess the relation between parental stress and the quality

and quantity of parent-child interactions. The findings suggested a statistically significant negative association in baseline between higher parental stress and the quality of parent-child interaction, specifically, mothers' responsiveness to their children's initiations. Furthermore, mothers' stress levels were significantly negatively associated with the number of mands emitted by the mothers during the free-play task in the pre-intervention condition, and in both tasks after the intervention, but not associated with the quantity of the other vocal-verbal operants.

The Effects of the Intervention on the Quantities of Mother-Child Relationships

We assessed the changes on the quantity of mother-child interactions, specifically in terms of the number of verbal operants initiated by the mothers (i.e., mands and tacts), and the number of approvals vs. disapprovals. Since the IY-ASLD teaches parents to follow the child's lead during play and to use descriptive commenting on the child's actions, to use behavior-specific praise, to reduce the number of commands and give clear, brief, positive instructions, and to selectively ignore undesirable behaviors, we hypothesized that following the intervention, there would be an increase in the number of tacts and approvals emitted by the mothers, and a decrease in the number of mands and disapprovals.

Quantities of Mothers' Tacts

We examined the changes on the number of mothers' tacts in both tasks and across all three conditions after they participated in parent training. Our findings showed a statistically significant increase in **the number of tacts,** $F_{r\,(2)} = 6.13$, $p = .047$. Post hoc analysis revealed that this increase occurred after the parents underwent half of the intervention. This finding supported our original hypothesis and is also consistent with previous research on the effects of parent

training programs in increasing the quantity of parents' speech. This increase in tacts could be linked directly to the program's emphasis on teaching parents to engage in 'child-directed narrated' play, and the use of more descriptive language and labeling during play and interaction with their children.

Quantities of Mothers' Approvals.

When looking at the **number of approvals**, the results of the Friedman test also showed a statistically significant decrease in the number of approvals emitted by the mothers in the free-play task, $F_{r\,(2)} = 7.42$, p = .024, which does not support our hypothesis that mothers will emit more approvals following the intervention. Post hoc analyses were conducted using the Wilcoxon signed-rank test and the results showed that the statistically significant decrease occurred from pre-intervention (T1; $M = 16.18$, $SD = 9$) to mid-intervention (T2; $M = 8.5$, $SD = 6.4$), $Z = -2.82$, $p = .005$. However, after looking at the mean, we noticed that mothers' approvals did in fact increase from mid-intervention to post intervention (T3; $M = 11.71$, $SD = 11.79$), $Z = -1.65$, $p = .09$, albeit not significantly. Therefore, this evidence does not support our original hypothesis. The decrease in approvals emitted by mothers in the free-play task was unexpected and does not align with the program's focus on positive reinforcement and praise. Nonetheless, it is important to note that the program does include specific strategies for providing positive reinforcement, and approvals to children, such as delivering contingent behavior-specific praise, which have been shown to be effective in improving child behavior and verbal behavior outcomes (Webster-Stratton & Reid, 2014). It is also worth noting that upon further investigation of the raw data, it was revealed that one participant in particular, *Participant 2*, emitted a total of 34 approvals during baseline, while the second highest participant emitted 10 approvals fewer

than that. Interestingly though, in the mid-intervention, *Participant 2* emitted the lowest number of approvals in the group, a total of two approvals, but was the second highest in the post-intervention, 18 approvals. This resulted in a curvilinear relationship. Perhaps it's worth exploring the results if we looked at the quantities of approvals without *Participant 2's* data.

Quantities of Mothers' Mands and Disapprovals.

When evaluating the changes in the number of mothers' mands and disapprovals, the Friedman's and Wilcoxon signed-rank tests showed that the number of mands emitted by the mothers during the structured-play and free-play tasks did not change significantly. Similarly, the number of disapprovals during both tasks did not change following the intervention. Since the IY-ASLD program teaches parents to reduce the number of commands (i.e., mands) and give clear, brief, positive instructions, and to selectively ignore undesirable behaviors, our original hypothesis predicted that mothers would emit fewer mands and disapprovals. Based on the data, we cannot reject the null hypothesis, nor do we have enough evidence to support our prediction. However, the participants overall emitted a very low number of disapprovals even before the intervention began. For example, in the pre-intervention, 52.2% of the participants emitted zero disapprovals in the structured-play task, and 47% in the free-play task, and aside from one participant emitting ten disapprovals, the remaining participants emitted fewer than three disapprovals throughout. In this case, the data may have been clustered towards the lower end of the scale, resulting in floor effects.

The Effects of the Intervention on the Quality of Mother-Child Interactions

We assessed the changes on the quality of mother-child interactions as measured by mothers' responsiveness to their children's initiations (i.e., mothers' responses), mothers' effectiveness in eliciting a response from their children (i.e., children's responses), and on the number of missed opportunities (no responses) for mothers and for children. Since the IY-ASLD teaches parents to encourage social-verbal interactions by using a language that is tailored to their child's level of verbal behaviors, by waiting for their child to respond before responding themselves, and by demonstrating enthusiasm when responding to their child's initiations, we hypothesized that following the intervention, there would be an increase in the number of mothers' responses to their children's initiations, and the number of children's responses to mothers' initiations. We also hypothesized that there would be a decrease in the number of missed opportunities for both.

Mothers' Responsiveness to Children's Initiations.

We assessed the changes in the number of children's responses that were reinforced by the mothers. The results of our analysis of showed no statistically significant changes in both tasks. Based on the data, we do not have enough evidence to support our prediction. However, although this study mostly focused on assessing changes in mothers' behaviors, and not the children's, we did calculate the number of children's initiations and noticed that they mostly remained the same throughout. The children emitted an average of 43 initiations, with a small range of 45 to 41 responses across the three conditions. Therefore, the results of this research question do not necessary mean that there weren't statistically significant changes in mothers' responsiveness, it merely shows that there weren't changes in children's initiations. With that being said, in another study that explored the relationships between mothers and their children,

Briggs-Greer (2018) found that children at the foundational level of verbal behavior often communicated using non-lexical and non-vocal verbal behaviors, which their mothers frequently did not attend to or reinforce. It would be interesting to see if the number of children's non-lexical and non-vocal initiations did increase but went unnoticed by their mothers.

Children's Responses to Mothers' Initiations

The findings indicated that there was a significant decrease in the number of children's responses to mothers' initiations (i.e., children's responses) in the free-play task after half of the intervention was completed, while there were no significant changes observed in the structured-play task. However, this change was not in the direction which we predicted. The number of mothers' responses that were reinforced by their children decreased; therefore, we cannot reject the null hypothesize. Since we predicted an increase in children's responses to mothers' initiations, but the data show otherwise, one possible explanation for the results we got could be clarified by looking at the results of the first question, specifically, the statistically significant increase we detected in the number of tacts that mothers emitted, precisely in the free-play task, and the lack of change in the number of mands. Although an increase in the number of tacts a child is exposed to is desired, but tacts, by definition, do not necessarily require a specific response (i.e., reinforcement) from the listener. Tacts are evoked by a non-verbal stimulus control (an antecedent) and are maintained by a generalized consequence. Skinner (1957) defined a tact as a "verbal operant in which a response of a given form is evoked by a particular object or event or property of an object or event" (pp. 81– 82). Mands on the other hand, occur under conditions of motivation, deprivation, or aversive stimulation, and are reinforced by the

presentation of the desired stimulus or the removal of the aversive stimulus (Greer & Ross, 2008).

Missed Opportunities for Mothers and Children

We examined the changes on the number of missed opportunities for both mothers and children following the IY-ASLD® intervention. Specifically, the number of mothers' no responses to children's initiations, and the number of children's no responses to mothers' initiations across all three conditions. The results revealed that the number of mothers' no responses decreased significantly during both tasks. For children, the number of no responses to mothers' initiations during the structured-play task decreased significantly from pre-intervention to post-intervention, while the number of no responses during the free-play task did not change significantly across all three conditions. The decrease in mothers' missed opportunities in both tasks, and the decrease in the children's missed opportunities in the structured-play task support our original hypothesis. The lack of any statistically significant changes in the children's missed opportunities in the free-play task align with the findings and explanations of question 2b, children were not responding to their mother's initiations since mothers started emitting fewer mands and more tacts, which do not necessarily require a specific response (i.e., reinforcement) from the listener.

Correlations Between Parental Stress and the Quality and Quantity of Mother-Child Interactions

We investigated the relation between maternal stress levels and the quality and quantity of parent-child interactions during free-play and structured-play tasks. Based on research on the characteristics of stressed mothers' language, we hypothesized that there would be a negative

association between parental stress and mothers' responsiveness to their children's initiations, their use of positive language (i.e., approvals), and their use of descriptive language (i.e., tacts). We also hypothesized that there would be a positive association between parental stress and their use of negative language (i.e., disapprovals), and controlling language (i.e., mands) (Beckerman et al., 2018). Before we discuss the results of these tests, it must be mentioned that our examination of the correlational analysis of parental stress and its association with the quality and quantity of parent-child interactions might have yielded some interesting results, but they must be interpreted with caution as this population had an extremely low level of stress according to their PSI-4 scores. Of the 17 participants, 15 fell within the normal stress range (15^{th} – 18^{th} percentile), while one participant had high stress level (82^{nd} percentile), and another participant had clinically significant stress (96^{th} percentile).

Parental Stress and the Quality of Mother-Child Interactions.

We examined whether maternal stress levels were associated with how responsive the mothers were to their children's initiations. The results showed a moderate negative correlation between maternal stress levels, as measured by the PSI-4 total score, and the number of mother's responses to child's initiations (i.e., mothers' responses) in the free-play and structured-play tasks, at the pre-intervention condition. Such that those with higher stress level at T1 had responded to significantly fewer child initiations in both structured-play and free play tasks. This finding supported our original hypothesis and is also consistent with previous research on the effects of stress on parental responsiveness. A study by Doussard-Roosevelt et al. (2012) found that higher maternal stress levels were associated with less responsive behaviors towards their children. The results showed no significant association in the post-intervention condition. The

lack of significant association in post-intervention between maternal stress and mothers' responsiveness is also aligned with the significant decrease in mothers' missed opportunities from pre-intervention to post-intervention.

Parental Stress and the Quantity of Mothers' Tacts

We explored whether maternal stress levels were associated with the number of vocal verbal operants emitted by the mothers during free-play and structured-play tasks, specifically tacts. The results showed no significant association between maternal stress levels and the total number of mothers' tacts during either one of the two tasks at both conditions. We originally predicted that there would be a negative correlation between parental stress levels and mothers' tacts, based on the past literature suggesting that stressed mothers talk less to their children.

Parental Stress and the Quantity of Mothers' Mands

Our analysis on the association between maternal stress levels and the number of mands emitted by the mothers during free-play and structured-play tasks, revealed a statistically significant moderate negative correlation at baseline and after the intervention, meaning, mothers with higher levels of stress emitted fewer mands. This was the opposite of what we have predicted based on previous literature.

Parental Stress and the Quantity of Mothers' Approvals and Disapprovals

We examined whether parental stress levels were associated with the number of approvals and disapprovals emitted by the mothers. The results showed no significant correlation between maternal stress levels and the total number of mothers' approvals or disapprovals during either task at both pre- and post-intervention phases. Our original assumptions predicted that stressed mothers would engage in more negative language (i.e., disapprovals) and less positive

language (i.e., approvals). Similar to the findings of the previous research question, the lack of correlations could be attributed to the fact that 88% of the mothers in this group had stress scores that fell within the typical range. Furthermore, as mentioned above, the participants overall emitted a very low number of disapprovals even before the intervention began. Therefore, the data was already clustered towards the lower end of the scale, resulting in floor effects. Thus, the use of observational measures that elicit challenging parenting situations, such as a don't-touch task (Bennett et al., 2006), is needed to reduce the limitation of social desirability to a minimum.

Limitations and Suggestions for Future Research

Our quasi-experimental study assessing the effects of a parent training program on the quality and quantity of parent-child interactions was limited by several issues affecting its internal and external validity, most notably the lack of a control group. Without a control group, we could not establish a causal relationship between the parent training program and changes in parent-child interactions. This is a common issue related to internal validity in quasi-experimental studies, as other factors, such as history, maturation, or regression to the mean, may have influenced the results. Another limitation of our study was the small sample size, which is a common issue related to external validity in research. With only 17 participants, our study had limited power to detect smaller effects of the intervention, and it was difficult to draw firm conclusions about the effects of the parent training program. Moreover, the population that we studied may not be representative of the general population, which is another issue related to external validity. The mothers who participated in our study were mostly from high-income households, with 50% of them making more than $200k annually. Additionally, the group was

highly educated, with 53% of the mothers having advanced degrees and 41% having a bachelor's degrees. This limits the generalizability of our findings, as the effects of the parent training program may be different for mothers from different socioeconomic backgrounds.

In addition, our study was limited by the potential for selection bias related to maternal stress levels. Although we found some correlations between maternal stress and the quality and quantity of parent-child interactions, majority of our mothers, 88%, scored in the normal range on the Parenting-Stress Index. This suggests that maternal stress may not have been a major factor in our study, but it also raises the possibility that mothers who experience high levels of stress may have been less likely to participate in the study, which could limit the external validity of our findings. Better outreach attempts and flexible scheduling could potentially attract this population that could highly benefit from a parent training program.

Another possible limitation of the study was that the level of optimal parenting observed in some of the parents during baseline. The school from which these parents were recruited, which applies the principles of behavior analysis, offers regular parent training through workshops and literature, but the researchers did not assess whether the parents had previously participated in those services. Additionally, the study took place during the pandemic, at a time when students were attending school virtually, and the mothers had the opportunity to observe their children's teachers using behavioral strategies via Zoom. During the parent-child interaction sessions, we anecdotally noticed that several mothers used behavioral tactics such as least-to-most prompting, gaining the child’s attention before delivering antecedents, and appropriately providing consequences by offering ample positive reinforcement and refraining from the use of disapprovals. This may have presented us with a ceiling effect, where many parents were already

delivering a high quality and quantity interactions with their children. Future research should consider controlling for the level of previous parent training during recruitment.

Several observations in our findings were possibly linked to Hawthorne effects, or simply reactivity, where the participants might have modified aspects of their behavior in response to their awareness of them being observed. A possible solution for future researchers would be to avoid having parent-child interactions at a table setting with a camera facing them. Instead, they could opt for a more relaxed setting, such as the family living room or the child's playroom, while wearing a recording devices. The Language ENvironment Analysis (LENA) System, such as the one Gilkerson and colleagues (2017) would be a helpful tool to use. LENA is an audio recording and automated voice labeling device which allows for the efficient collection and analysis of large amounts of naturalistic language samples. Additionally, in order to eliminate reactivity and social desirability, it has been suggested that observations of parenting are done in more stressful tasks, such as a ‘don’t touch’ task (Bennett et al., 2006).

Lastly, most research on parenting stress have relied on self-report measures and questionnaires, although several studies have investigated the construct validity and reliability of the widely used measures, self-report measures are inherently subjective and can result in false connections. In contrast, using physiological indicators like cortisol, EDA, and heart rate measurements can provide more objective data to assess the health and wellness of parents with children who have neurodevelopmental disabilities. As a result, recent studies have focused on exploring the potential of these physiological markers to gain a better understanding of parenting stress (Bennett, et al., 2006). Future studies should attempt to assess the association between

parental stress levels and the changes in their physiological indicators while evaluating parent-child interactions.

Educational Implications and Conclusion

The contents and the objectives of the Incredible Years-ASLD® program are comprehensive, and parents' satisfaction surveys after the completion of the program show that they greatly appreciated the knowledge and support they received. One parent said "I learned so much that I could apply to my daily interactions with my child and made some friends along the way! We are planning a play date soon and look forward to meeting in person and having our kids play too . . . I learned so many easy tactics that are great to have in my toolbox." Our intervention may have given parents the peer support they needed, which has been found to increase participation and positive outcomes in behavioral parent training programs (Axford et al., 2012; Barrett et al., 2008). Strengthening social support among parents through interventions such as multifamily or multiparent group formats can also have additional benefits, including reduced stigma, increased connection, and reduced isolation (Kaplan et al., 2014; Schrank et al., 2015; Wan et al., 2008). Participating in group parenting classes allows for sharing experiences and receiving peer support, which can be a significant motivator for parents (Coatsworth et al., 2006). Peer support has been found to help parents learn effective parenting strategies and positively engage with their children (Dixon et al., 2001, 2011).

However, changes in parental and child outcomes could be amplified if the program incorporated the delivery of more direct feedback to the parents during parent-child interactions. This could be done by simply asking the mothers to record themselves interacting with their

children and later receiving feedback on what they did well, and on what has more room for improvement. Researchers have emphasized that a key method to effectively teach parents new skills is by providing ample opportunities for the parents to practice while receiving direct feedback from the clinicians, highlighting that feedback should be concise, frequent, immediate, and positive (Ingersoll & Dvortcsak, 2006; Kaminski et al., 2008). Most parent training programs contain the following elements: (a) the clinician reviews written materials and introduces the teaching techniques; (b) the clinician models the new procedure; (c) the parents practice implementing the new procedure; (d) clinician delivers immediate feedback and coaching to the parents (Ingersoll & Dvortcsak, 2006). Wyatt Kaminski et al. (2008) conducted a meta-analysis of 77 studies for parent training programs to examine the specific components of each program that were associated with significantly larger effects on child behaviors. Results of their analysis showed that, regardless of the program's content or delivery format, the component associated with larger effects was requiring parents to practice the skills with their children during the parent training sessions. Ingersoll and Dvortcsak (2006) went further to warn against 'wasting time' on modeling over providing parents the opportunity to practice the newly taught skills. Future research might consider evaluating the effects of the addition of a "bug-in-ear" element to the IY-ASD program on the quality and quantity of parent-child relationships.

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Tables and Figures

Table 1

Demographic and Clinical Information of Parents-Child Dyads

Participants (n=17)	*Value*
Parent Race/Ethnicity*	
Asian or Pacific Islander	2 (12%)
Black	1 (6%)
Hispanic, Latino, Spanish origin	3 (18%)
White	12 (71%)
Parent Country of Origin	
Born in US	12 (59%)
Born Outside US	7 (41%)
Parent Employment Status	
Full Time	8 (47%)
Part Time	2 (12%)
Not Employed	6 (35%)
Parent Education Level	
Some College	1 (6%)
Bachelor's Degree	7 (41%)
Advanced Degree	9 (53%)
Household Income Level	
$15,000 to $24,999	1 (6%)
$50,000 to $74,999	2 (12%)
$75,000 to $99,999	1 (6%)
$100,000 to $149,999	2 (12%)
$150,000 to $199,999	2 (12%)

$200,000 or more	9 (53%)
Children in Household	1.94 (±0.97)
Only child	7 (41%)
Two children	5 (29%)
Three children	4 (24%)
Four children	1 (6%)
Sibling has Dev. Delay	2 (12%)
Child Gender	
Male	15 (88%
Female	2 (12%
Child Age (months)	51 ± 8.6
Child Vineland Adaptive Behavior (VABS)	
Adaptive Behavior Composite SS	70 ± 6.00
Communication Level SS	76 ± 8.23
Daily Living Skills Level SS	72 ± 7.32
Socialization Level SS	63 ± 12.25

Note: Values are counts with percentages or M ± SD.
* Participants are listed in each racial category they reported. Therefore, totals in this section are greater than sample size and percentage exceed 100%
** VABS = Vineland Adaptive Behavior Scales: Standard Score (SS) has a mean of 100 and Standard Deviation of 15; V-scale score has mean of 15 and Standard Deviation of 3.

Table 2

Correlations Between Parenting Stress Index Fourth Edition, Short Form (Abidin, 2012) Scores and Variables at Baseline.

	PSI	1	2	3	4	5	6	7	8	9	10
Mothers' Responsiveness (SP)	-.579*	--									
Mothers' Responsiveness (FP)	-.514*	.704**	--								
Mands (SP)	-.13	.23	.03	--							
Mands (FP)	-.566*	.17	.24	.629**	--						
Tacts (SP)	-.14	.10	.25	-.41	-.13	--					
Tacts (FP)	-.08	.03	.32	-.536*	-.12	.45	--				
Approvals (SP)	.23	-.09	-.27	.02	-.20	-.04	-.08	--			
Approvals (FP)	-.21	.530*	.36	.668**	.484*	-.495*	-.17	.03	--		
Disapprovals (SP)	-.11	.00	-.25	.38	.47	.08	-.524*	-.10	-.09	--	
Disapprovals (FP)	.00	-.18	-.10	.37	.575*	-.33	-.20	-.17	.26	.486*	--

Note. Spearman correlations were conducted. Significance levels: *p < .05 **p < .01.
SP = Structured-Play Task, FP = Free-Play Task

Table 3

Correlations Between Parenting Stress Index Fourth Edition, Short Form (Abidin, 2012) Scores and Variables at Post-Intervention.

	PSI	1	2	3	4	5	6	7	8	9	10
Mothers' Responsiveness (SP)	-.47	--									
Mothers' Responsiveness (FP)	-.32	.596*	--								
Mands (SP)	-.492*	.02	.20	--							
Mands (FP)	-.723**	.07	.24	.650**	--						
Tacts (SP)	-.17	.04	-.04	-.23	-.08	--					
Tacts (FP)	.17	.03	-.03	-.23	-.33	.35	--				
Approvals (SP)	.21	.10	-.28	-.34	-.25	.32	.16	--			
Approvals (FP)	.20	.18	.30	.21	-.14	-.14	.19	.01	--		
Disapprovals (SP)	-.27	.21	.53	.568*	.32	-.12	.13	-.35	.18	--	
Disapprovals (FP)	-.32	.05	.22	.680**	.524*	-.37	-.10	-.33	.01	.870**	--

Note. Spearman correlations were conducted. Significance levels: *p < .05 **p < .01.
SP = Structured-Play Task, FP = Free-Play Task

Appendix A

Contents and Objectives of the Incredible Years - Autism Spectrum & Language Delays Program.

Part One: Child-Directed Narrated Play Promotes Positive Relationships

- Value of parents giving focused child-directed attention during play as a way of promoting positive relationships.
- Understanding how to get in a child's attention spotlight and not letting the child exclude you.
- Understanding how to narrate child-directed play to build language development.
- Learning how to transition to new play learning opportunities.
- Appreciate the importance of parental gesturing, imitation, modeling, face to face interactions, and visual prompts.
- Value of using picture choice cards.
- Choose games that address your child's sensory needs but avoid overstimulating.
- Understanding times *not* to follow your child's lead.

Part Two: Pre-Academic and Persistence Coaching Promotes Language Development and School Readiness

- Determining appropriate developmental goals for children on the autism spectrum.
- Tailor pace, amount, and complexity of language modeled according to child's communication stage.
- Understanding the value of persistence coaching for promoting children's attention span and managing their frustration.
- The modeling principle—and importance of positive affect and exaggerated facial responses.
- Staying in child's attention spotlight by being responsive.
- Understanding the value of prompting and pre-academic coaching for building children's language skills and school readiness.
- Learning to coach pre-reading readiness.
- Adjusting verbal and non-verbal language and visual prompts according to children's communication stage.
- Responding to child's language as meaningful even if not understandable or conventional.
- Using visual supports such as gestures, pictures, and concrete objects to help child understand what others are saying.

Part Three: Social Coaching Promotes Friendship Skills

- Social coaching and one-on-one child-directed play promotes a child's social skills.

- Understanding how to model, prompt, and coach a child's social skills.
- Respond enthusiastically and with praise whenever child shares or helps you (exaggerate responses).
- Understanding how to: Use songs, physical games, and sensory routines to optimize a child's social learning opportunities and draw attention to parent's face.
- Encourage back and forth communication by pausing to wait for child's response or signal before giving child what he/she wants.
- Use puppets and pretend play to encourage social communication.
- Use social coaching at dinner, bedtime, and dressing time.

Part Four: Emotion Coaching Promotes Emotional Literacy

- Emotion coaching promotes children's emotion language skills and empathy.
- Emotion language is a precursor to self-regulation.
- The "attention rule"—the principle of paying attention to more positive than negative emotions and modeling positive expression of emotions.
- Understanding how to respond effectively to negative or uncomfortable emotions.
- Learning how to combine emotion coaching with social and persistence coaching.
- Using feeling picture cards to promote children's understanding of feelings words and beginning empathy.

Part Five: Pretend Play Promotes Empathy and Social Skills

- Understanding the value of pretend play with puppets to promote children's social skills and empathy.
- Understanding the most effective ways to use puppets with children.
- Developing scenarios and practicing using them to promote children's social skills, empathy, and emotion language.
- Understanding how to use puppets and action figures along with books.

Part Six: Promoting Children's Self-Regulation Skills

- Determining when children are receptive to learning about calm down teaching or self-regulation prompts (e.g., positive self-talk, deep breathing, happy images)
- Understanding how to use pretend and puppet play to do self-regulation teaching and practice.
- Learning how to explain the calm down thermometer to children and practicing strategies.
- Importance of using the ignore technique when child is too dysregulated.
- Understanding concept of "selective attention."
- Parents modeling self-control and calm-down strategies.

Part Seven: Using Praise and Rewards to Motivate Children

- Learning how to spotlight labeled praise for children.
- Identifying child's "positive opposite" target behavior to praise and reward.
- Understanding how to set up a developmentally appropriate plan of child social behaviors.
- Recognizing the value of sensory activities and rewards for children.
- Learning how to praise and reward oneself and others for parenting efforts.
- Importance of developing a parent support network.

Part Eight: Effective Limit Setting and Behavior Management

- Understanding how to give clear, brief, positive instructions.
- Using parent visual command cards as needed to make command understandable.
- Reduce number of commands to only necessary commands/instructions.
- Learning about the importance of giving children transition time and reminders.
- Understanding when to use redirections and physical prompts (guiding hands).
- Establishing clear and consistent household rules.
- Learning how to re-engage children in new learning opportunity when misbehavior subsides.
- Identify behaviors that can be ignored.

Appendix B

Parent-Child Interactions Instructions for Parents

Instructions for Brief At-Home Activity & Play Session

Step 1: Setup: Please sit at a table with your child in an enclosed room with minimal distractions. Place your laptop or tablet across from where you and your child are seated so that you are both in the frame of the camera. Please do your best to remain seated and in frame of the camera while you play.

Step 2: First Task

- **What Do I Need?**
  - Crayons and two sheets of blank paper.
- **What To Do?**
  - Spend 5 minutes teaching your child how to draw the picture the researcher has given you.
  - The researcher will tell you when to begin and when to end!

Step 3: Second Task

- **What Do I Need?**
  - A bunch of toys your child would like to play with (suggestions: shape sorter, pop-up, magnet tiles, connect four, paper & crayons, toy vehicles)
- **What To Do?**
  - Play with your child as you normally would for 5 minutes.
  - The researcher will tell you when to begin and when to end!

Step 4: Clean Up

- **What Do I Need?**
  - A bag or bin/ container to put toys back in (eg any small bag, bin, box, ziplock that will be visible on camera, not in a different room)
- **What To Do?**
  - Tell your child to clean up. Please don't clean up by yourself.
  - The researcher will tell you when to begin and when to end!

THANK YOU!

Appendix C

Script Used by the Experimenters During Parent-Child Interactions.

Instructions: Parents will be instructed to engage in a parent-child play session that will be recorded by the researchers via a Zoom recording.

Parent-Child Interaction Script:

1. Introduction. The experimenter has joined the family via Zoom. The parent and child are seated at a table. Experimenter says "Hello [parent name]. Thanks for joining us today! Nice to meet you [child's name]. My name is [experimenter name]. You and your mom are going to play some fun games together today!"
2. Setup:
    1. "Before we get started let me go over a few things that will help us during this session.
        1. First, we want you and [child's name] to do your best to stay at the table while you're playing. Please try to do your best to remain in frame of the camera by staying at the table.
        2. Also, to help keep [child's name] focused on the tasks today it would be best to remove any possible distractions (TV, tablets/phones, family members, extra toys, food). We want to start with a clear table, with the materials off to one side, out of reach of ___ for now. I'll let you know when to grab certain things. Please save all clean-up for the end as we have a specific clean-up task.
        3. Do you have all the toys you need nearby?

            __Two sheets of blank paper

            __a box of markers or crayons

            __ a bunch of toys

    iv. [Optional: request adjustments with lighting, only if needed.

        Optional: If they seem to be in highchair: clarify if the child is secured in a chair with a strap or not? Tell the parent we have NO preference from us just want to clarify. Record in notes

Great. Looks like we are ready to start. Experimenter will begin recording the session.

3. Parent Instructions. “I’m going to give you instructions on some activities you and [child’s name] are going to do together. Each activity will be 2 to 5 minutes long. During these activities, we want you to respond to [child’s name] the way you normally do.”
4. Task #1: Structured-Play Task (5 minutes). “Okay, let’s get started. Mom, please bring crayons or markers as well as the sheets of plain paper you’ve put aside. You’re going to teach [child’s name] to do a drawing. Do you think your child would rather draw a flower, a house, or a puppy [for PV group a scribble]? When you finish your drawing, you can color it or draw something else. You will have 5 minutes. Let’s get started”!
5. Experimenters will turn off their camera, start timer for 5 minutes, and write down any notes about P-C interactions that may be difficult to see on camera. After 5 minutes of the teaching task, the experimenter will turn their camera on and congratulate the child on a job well done, “That’s time. Great job! Can you show us your drawing? Wonderful.”
6. Task #2 – Free Play Task (5 minutes). “Alright, for this next task [parent’s name] let’s bring out a bunch of toys your child might like to play with (Magnet Tiles, Papers and crayons, Toy vehicles, Pop up toy, Shape Sorters, Connect 4). Can you please bring several options to the table. Please spread them out so your child can see all the options and all the pieces. It would help if you could pour out the [crayons; magnet tiles; shape pieces].
7. Instructions for free play: “Great! I’d like [you] to play with [child’s name] as you normally would. Do you have any questions?” Experimenter will answer any questions. “Ok, I am going to turn off my camera and I’ll be back in five minutes.”
8. Experimenter will turn off the camera, start the timer for 5 minutes, and write down any observations of the parent child interaction that may be difficult to see on camera. After 5 minutes, enter the Zoom room and say, “All done. Nice job!”
9. Next, the experimenter tells the family “Okay, that was the last task. You did such a great job today! We’re all done. Do you think this provided a typical example of how you interact with your child? If no, how was it different that it usually is? Do you have any questions or comments? Answer any questions Thank you.”

Experimenter will stop recording, turn off the camera, end the session.

Appendix D

Transcribing and Coding Guidelines

First pass (Transcript) What was said and done by another mother and child.

Use "New Blank Template" to Create your Vocal Transcript

How to transcribe

- Note in first column speech or action is from mom (m) or child (c)
- Write down everything the mom says vocally.
- Write down everything that child says vocally.
- Write [x] as its own line for clear listener response (describing the x is often helpful, e.g., x - child looks at mom).
- Use placeholder code [u] for anything unintelligible, describing the [u] is helpful ... Can include [u] laughing, [u] "reeee" or unclear word attempts] add time stamp.

Format the transcript

- Add punctuation as much as possible. (Question marks, periods, etc.)
- Line break to new transcript cell when:
    - There is a 3 second pause (add time stamp)
    - OR when speaker changes
    - OR if the child emits a *clear listener response*,
        - *What is a clear listener response?*
        - Clearly looking at object being discussed or clearly looking at a speaker.
        - Complying with a direction (picking up a crayon when asked).
        - Clear noncompliance with direction (push away)

Add Vocal Verbal Operant Codes

- Code # mands, tacts, approvals, disapprovals, during transcription.
- These codes should appear on the line of transcript they are describing.
- There will be multiple codes in this section.

Second pass) Code Reinforcement as Speaker or Listener Responses --

- How did the other person respond to this line of transcript (speech or behavior)
- Was it reinforced with speaker behavior, listener behavior, or not reinforced at all?
- Determine how transcribed speech was reinforced:
- Look at the line immediately below in the transcript, this will help you code the reinforcement response. immediately next in the transcript was it…

    - 1) reinforced with "speaker" behavior in the form of vocal verbal words, vocal nonlexical sounds, or nonvocal verbal communications (physical/ body language)
    - 2) reinforced with “listener only” behavior, observing, compliance
    - 3) not reinforced (no clear observable listening, attending)
- Pick only 1 consequence type, only 1 code in this section
  note the hierarchy: verbal vocal > nonlexical > nonvocal> listener > no response.

Appendix E

Coding Guidelines

Vocal Verbal Operants (VVO) Codes includes Mands, Tacts, Approvals, Disapprovals

APPROVALS

Approvals = vocal or non-vocal verbal behavior to endorse, commend, and praise the correct, or desired behaviors, or a positive attempt to engage the child

These actions function to reinforce behavior.

Only code mom approvals -- not child

- Vocal approvals were approvals delivered vocally with audible sounds (e.g., "You are playing so nicely," "You are awesome at this," "I love you").
- Non-lexical approvals were vocal responses that did not contain real words/ word attempts, such as laughs or approving sounds (e.g., "Wee!").
- Non-vocal approvals were defined as approvals delivered through, gestures, or physical contact. For example, a gesture thumbs up, claps), or physical contact (e.g., high fives, fist bump, hugs, tickle, kiss).
- "Thank You" after a desired/requested behavior is performed is coded as approvals.
- Code approval when one repeats what the other says (e.g., after they ask for the name of something), or when an echoed statement functions like approval to reinforce behavior/what was said.
- M: what's this? (mand)
  C: baby (tact)
  M a baby! (approval)
- C: Let's try again (tact)
  M: Let's try again! (approval)
- Do not double code approvals as tacts/mands. Approval/Disapproval trumps tacts/mands.

DISAPPROVALS

Disapprovals were defined as Vocal and Nonvocal verbal behavior in attempt to reprimand or punish inappropriate behaviors OR express overt disagreement, noncompliance.

Only code mom disapprovals -- not child

- A vocal disapproval was defined as a reprimand delivered vocally with audible sounds (e.g., "No," "Stop that," "Don't do that," "That's not right").

- Non-lexical disapprovals were vocal responses that did not contain real words/ word attempts, such "Uh-uh" (to indicate "no don't do that")
- Non-vocal disapprovals were defined as reprimands delivered in the form of gestures (e.g., finger or handheld up to represent “No” or “Stop”), or physical contact (e.g., slaps, hits, kicks, or pushing hands away).
- Do not double code disapproval as tacts/mands. Disapproval trumps those codes.

MANDS

Mands = vocal verbal speaker behaviors that attempt to evoke a behavior or response from another person (e.g., request for action, attention, object, information,)

- *Look here.* -- mand for attention
- *Take the crayon* -- mand for action.
- *Let's go come on* -- mand for action.
- *Which one do you want?* --- mand for information
- *How are you doing?* -- mand for information.
- *Is that wet?* -- mand for information.
- *Give me that one.* -- mand for object

Hint: Ask, what is the purpose of this speaker's behavior? To get someone to do something.

TACT

Tact = vocal verbal description of something in the environment (objects, actions). Includes neutral commenting on one own's behavior or someone else's behavior.

- *That's a square.*
- *Mommy is opening the book.*
- *Here is a flower, so pretty.*
- *You have the black crayon.*
- *I found it!*
- *We are going to play!*

Hint: Ask, what is the function of the speaker's behavior? To label or describe something.

Code tacts when a child echoes on command, for example, if mom says something like “say blue” and child says “blue.”

REINFORCEMENT CODES:

Includes: Speaker (vocal verbal lexical, vocal non lexical verbal, non-vocal verbal) or Listener or No Response

SPEAKER BEHAVIOR

(These count toward conversation units, or intraverbals)

Vocal Verbal (Lexical) Behavior

- Vocal verbal behaviors consist of speaker responses emitted across verbal operants. These are communicative responses that function as either ***initiations*** or ***responses*** between two or more persons in the same verbal community (i.e., conversation) or by talking to themselves (i.e., self-talk).
- Vocal verbal responses are emitted in an audible form with lexical vocalizations (i.e., containing words, phrases, or sentences).

- Example, spoken sentences, words, AND clear word attempts***
  NOTE: Word attempts should be captured phonetically in the transcript (e.g., attempt "car" looks like "kaa----" on transcript).

- Word attempts were considered "non lexical" category in prior study. We have updated that criteria, to better capture speech level of these children. There are many word attempts (audible vocalization of identifiable phonemes), and the parent responds as though it IS a full word (aka they can "translate" the speaker behavior of their child.).
- How to spot something that is "Reinforced with vocal verbal speaker behavior": When a child complies with a request (listener behavior e.g., looking at mom, picking up toys), mom does not have to praise that exact compliance specifically verbally. If she simply continues conversing, you can still code that she has reinforced with vocal verbal.

Vocal Non-Lexical Verbal Behavior

- Non-lexical vocal verbal behaviors consist of communicative speaker responses emitted across verbal operants with the same controlling variables and reinforcing functions as vocal verbal behavior.
- The differences are exhibited in the form of the responses in which the audible vocalizations do not contain lexicons.
- Example. Laugh, hmmm, grunts, a cry, whine, whimper.

Non-Vocal Verbal Behavior

- Non-vocal verbal behaviors consist of communicative speaker responses emitted across verbal operants with the same controlling variables and reinforcing functions as vocal verbal behavior.
- The differences are exhibited in the form of the responses. Gestures and actions are used as non-vocal functions to communicate, but no audible response is emitted.
- Examples:
  - pushing object away= ' I don’t want that"

- wave = "hello”.
- head nod/shake = "yes/no”.
- points/reaches to object = "I want that/ look at that”.
- reaching for parent hugging= "pick me up/ hug me")

- Exclude facial expressions/ smiles/ frowns (unfortunately a lot of our videos did not capture fully parents and child's whole faces, and thus we cannot accurately code facial expressions in this category)

LISTENER BEHAVIOR

(These do not count toward conversation units, or intraverbals)

Listener Behavior

- Observing, Orienting, Looking to parent to toward shared activities,
- Includes compliance without speech,
- Can include "physical" "Body language" and hand-over-hand compliance.

NOT REINFORCED

(Aka Nonverbal, NonSocial) **-** No social interaction, no communication function present

Includes:

- No listener response
- Babble that is ongoing, self-reinforcing
- Palilalia, scripting, self-reinforcing speech
- Stereotypy (verbal or physical)

UNKNOWN

Use this code when the subsequent reinforcement is unclear/ not immediate/ not obvious.