Vocal and Non-Vocal Verbal Behavior Between Mothers and Their Children Diagnosed with Autism Spectrum Disorder

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ABSTRACT

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I conducted a descriptive analysis on the emission of vocal and non-vocal social/verbal interactions between 35 dyads of preschool-aged-children diagnosed with Autism Spectrum Disorder (ASD) and their mothers. Using previously recorded videos of 5-min isolated free-play sessions between the mother-child dyads, I transduced each occurrence of verbal operants, attempted verbal operants (i.e., emissions not reinforced by a listener), and additional verbal behaviors such as fantasy play emitted by the child, and approvals and disapprovals emitted by the mother. Each verbal behavior was defined as either vocal verbal behavior, non-lexical vocal verbal behavior, or non-vocal verbal behavior, all with a function to communicate. The procedure consisted of identifying each instance of verbal behavior emitted between the mother and child rotating across listener and speaker responses until either no response occurred, or the session concluded. The listener and speaker responses were further transduced into individual initiated conversational units (speaker-listener-speaker rotations). These data were statistically analyzed with previously collected child educational variables and mother demographic variables: child's level of verbal behavior in accordance with the *Verbal Behavior Developmental Assessment-Revised* (VBDA-R), number of acquired objectives on the *Comprehensive Application of Behavior Analysis to Schooling International Curriculum and Inventory of Repertoires for Children from Preschool through Kindergarten* (C-PIRK), the *Autism Diagnosis Observation Schedule-Second Edition* (ADOS-2) severity scores, and the scores on the *Vineland-*

3 Adaptive Behavior Scales-Third Edition (VABS-3). The mother demographic variables were level of education and household income. The results of the study were as follow: (1) a significant relationship was shown between the child's level of verbal behavior (extracted from the VBDA-R) and performance on the C-PIRK, VABS-3, and between the ADOS-2 Modules used to assess for ASD severity; (2) the results did not show a significant difference between the child's level of verbal behavior and the number of child-initiated conversational units. The differences in the verbal behavior exchanged between the mother and child were, however, indicated across the child's *form* of verbal behavior – vocal, non-lexical, and non-vocal verbal behavior – emitted with the mother. Results are interpreted as parents of children without vocal verbal behavior require parent training tailored to their child's verbal developmental repertoires rather than their chronological age to ensure all communicative opportunities are captured. Educational implications, limitations, and future avenues of research are discussed.

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DEDICATION

I dedicate my work to my son, Grayson Pruitt Greer. I began this research when you were just a few months old. Now, at almost two-years-old, we have had millions of invaluable social/verbal interactions that will bond us forever. Knowing that every glance, smile, and reach of your hand was a mand for my affection; while the points and squeals were attempts for you to come in contact with your environment, has allowed me to reinforce your vocal and non-vocal verbal behavior. In doing so, I aim to begin your journey of acquiring all the necessary verbal behavior developmental cusps and capabilities for you to take on this world. May you forever reach for me and may I forever respond.

Chapter I

INTRODUCTION AND REVIEW OF THE LITERATURE

Introduction

Many different disciplines have studied the social interactions of mothers and their children. As a result, we have learned the importance mothers' attention plays on a child's development; however, what about the effect mother's attention has on the development of a child's *verbal behavior*? In this literature review, I identify the origin and theory of verbal behavior as proposed by Skinner (1957) and provide his seminal definitions of the six elementary verbal operants. In conjunction with verbal operants, the function of the three-term contingency as it envelops the core of all verbal behavior is explained. The subsequent components of the literature review discuss the role of social behavior and its relationship with verbal behavior. The review then focuses on the developmental trajectory of one's verbal behavior in a discussion on the verbal behavior developmental theory, and how one's level of verbal behavior is identified.

The focus of the study turns to the social interactions of mothers and their children. Within this section, I review the literature demonstrating how children are born wanting to interact with their mothers, as the mother's voice is the child's first conditioned reinforcer; thus, their first social interaction. I explain the importance of positive social/verbal interactions versus negative interactions. The literature on the language development of neuro-typically developing children is reviewed as well as the role mother's vocalizations and demographic characteristics play in language development. The literature review concludes with a description of the research on the language development and mother-child interactions of children diagnosed with autism

spectrum disorder (ASD).

Using video recorded free-play sessions between mothers and their child, I transduced each occurrence of vocal and non-vocal verbal behaviors in a rotated listener-speaker fashion to capture the occurrence of each social/verbal interactions. The verbal operants collected included: tacts, mands, echoics, intraverbals, and textual responses, along with attempted tacts and mands, written behavior, fantasy play, approvals, disapprovals, and no-responses. Each of these verbal behaviors were defined as either vocal verbal behavior (VB), non-lexical vocal verbal behavior (NL), or non-vocal verbal behavior (NV). Using a data sheet designed for the observation, letter codes representing each verbal behavior were circled as the corresponding behavior occurred. The data collection procedure rotated between listener and speaker responses until either no response occurred, or the session concluded. Upon collecting data across each dyad, specific behaviors were extracted and tallied: The number of initiated conversations units, attempted mands, no-responses, and NV emitted by the child and mother, VB, NL, and fantasy play emitted by the child, as well as approvals and disapprovals emitted by the mother. The data collected were then statistically analyzed with previously collected educational assessments: child's level of verbal behavior, ADOS-2 module and severity score, number of C-PIRK objectives, and Vineland-3 communication domain scores.

The rationale for conducting the current study on the vocal and non-vocal verbal behaviors emitted between preschool children diagnosed with autism and their mothers is to answer the following research questions: Are there relationships between a child's level of verbal behavior and various educational assessments? Are there relationships between the verbal behaviors emitted by the child with his/her mother during free-play sessions across the child's

level of verbal behavior? Are there any relationships between the mother's emission of verbal behavior across the child's level of verbal behavior and mother demographic factors?

Verbal Behavior

"Behavior which is effective only through the mediation of other persons has so many distinguishing dynamic and topographical properties that a special treatment is justified and indeed, demanded" (Skinner, 1957, p. 2). B.F. Skinner's 1957 publication of *Verbal Behavior* deciphered how one acquires language through the development of verbal behavior; therefore, Skinner referred to "language" as in fact, verbal behavior. Skinner defined verbal behavior as "…behavior reinforced through the mediation of other persons needs…" (p. 2). He later refined his definition by declaring: (a) a listener, whether himself or another person, must be involved, as he is to mediate the consequences of the speaker. Skinner clarified that verbal behavior is behavior reinforced through the behavior of other persons, or listeners, and these "other persons" are conditioned to reinforce the behavior of the speaker. Ultimately, Skinner sought to transduce the declarative communication of language into observable and measurable behaviors (i.e., the verbal operant).

Elementary Verbal Operants

A predecessor to the theory of verbal behavior was Skinner's (1938) classification of operant conditioning. This seminal approach to learning refers to how behavior changes due to reinforcing or punishing consequences; thus, distinguishing an operant as an environmental response that is either neutral, reinforcing, or punishing. Skinner's theory of verbal behavior explains how a verbal operant involves the speaker's behavior coming under the stimulus control of the listener, as the listener mediates the operant response through reinforcing consequences. Skinner (1957) lists the six-elementary verbal operants as follow: mands, tacts, echoics,

intraverbals, textual responses, and transcription. Refer to Table 1 for the seminal definition and corresponding linguistic analysis of language across Skinner's verbal operants.

Table 1

The Seminal Definition of Skinner's Verbal Operants and Corresponding Linguistic Analysis of Language

Verbal Operant	Seminal Verbal Operant Definition as proposed by Skinner (1957)	Linguistic Analysis of Language
Tact	A tact "carries a mnemonic suggestion of behavior which "makes contact with" the physical world. A tact may be defined as a verbal operant in which a response of a given form is evoked (or at least strengthened) by a particular object or event or property of an object or event. We account for the strength by showing that in the presence of the object or even a response of that form is characteristically reinforced by a given verbal community" (p. 81-82).	A form of expressive language used to label or name objects (i.e., a declarative statement).
Mand	"The term "mand" has a certain mnemonic value derived from "command," "demand," "countermand," and so on, and is conveniently brief. A "mand," then, may be defined as a verbal operant in which the response is reinforced by a characteristic consequence and are therefore under the functional control of relevant conditions of deprivation or aversive stimulation" (p. 35-36).	A form of expressive language used to request items
Echoic	"In the simplest case in which verbal behavior is under the control of verbal stimuli, the response generates a sound-pattern similar to that of the stimulus" (p. 55). A single echoic phoneme is the smallest unit of verbal behavior and the unit increases to sentences. The form of echoic behavior can differ loosely in pitch, speed, and tone. There are multiple indirect reinforcements of echoic behavior with the first reinforcer being educational.	The repetition or verbal imitation of a word or combination of words
Intraverbal	Intraverbal responses are "… verbal responses [with] no point-to-point correspondence with the verbal stimuli which evoked them" (p.71). "Since formal correspondence [between the antecedent and the response] are not at issue, we may consider both vocal and written stimuli and vocal and written responses in all four combinations at the same time" (p. 71). Skinner gives examples such as responses to greetings, questions, mands, the alphabet, counting, metaphors, etc. as intraverbal responses.	A form of expressive language used to answer a question
Textual Response	"A speaker under the control of a text is, of course, a reader" (p.65). "We are concerned here only with his vocal behavior as it is controlled by the written or printed stimulus. Since the term "reading" usually refers to many processes as the same time, the narrower term "textual behavior" will be used here. In the textual operant, then, a vocal response is under the control of a nonauditory verbal stimulus" (p. 65-66).	The act of reading or "decoding" of words
Transcription	"A response which creates a visual stimulus having a similar effect [to a vocal response] is also verbal according to our definition. Defined as copying of a text in written in which the "ultimate reinforcement depends upon a correspondence between response unit and stimulus unit…" (p. 70). He further explains that the written response can differ in topography of the symbols' shape and size.	The coping of written words

Note. Brackets around words indicate words the author added to the definitions.

Responses with autoclitics function to manipulate and extend one's verbal behavior (Skinner, 1957). The autoclitic response is a secondary verbal operant that acts as a metaphorical extension used to strengthen and specify one's verbal behavior through any of the following: a descriptive autoclitic (e.g., "I am *going* to the store"); mands placed upon a listener (e.g., "I want the *big yellow* truck mommy" (i.e., not any of the other trucks)); qualifying autoclitics (e.g., "I will *not* sit there"); and quantifying autoclitics (e.g., "Can I have *more* soup?") (Skinner, 1957). Simple mands and tacts are comprised of either one-word responses *or* responses with two or more-word autoclitic phrases; thus, the autoclitic is the speaker's verbal behavior that acts as either a discriminative stimulus (Sd) or motivating operation (MO) for the speaker to extend his or her verbal behavior.

Three-Term Contingency

Each verbal operant encompasses a three-term contingency: (1) evoked by an antecedent stimulus (2) followed by the emission of a verbal response, (3) and finalized with a reinforcing consequence. The antecedent controlling variables are either an Sd or a MO. The stimulus control or Sd is a specific stimulus that evokes a behavior due to a history of reinforcement with that stimulus (Michael, 1982) and is emitted in either a vocal, non-vocal, or non-verbal form. The MO is an environmental event that momentarily increases the effectiveness of a non-verbal or verbal stimulus (e.g., candy or video game) as a reinforcer, in addition to increasing the frequency of a behavior when it has been followed by that reinforcer in the past (Michael, 2007). Refer to Table 2 for a breakdown of each verbal operant across a three-term contingency.

Table 2

The Controlling Variable, Response Type, and Reinforcement for Each Verbal Operant

	Tact	Mand	Echoic	Intraverbal	Textual	Transcription
Controlling Variable	Non-verbal Sd (object or condition)	MO (information attention demand)	Vocal Sd	Vocal Sd	Non-vocal Sd (written)	Non-vocal Sd (written)
Response Type	Vocal Non-vocal	Vocal Non-vocal	Vocal	Vocal Non-vocal	Vocal (covert/overt)	Non-vocal (written, typed finger-spelled)
Reinforcement Type	Social	Specific	Social Natural	Social	Social Natural	Social Natural

Verbal Behavior vs. Non-Verbal Behavior

Skinner (1957) claims there is no specific form of verbal behavior, as "… any movement capable of affecting another organism may be verbal" (p. 14). His research emphasizes that verbal behavior is emitted in many different forms; and therefore, this research seeks to further define the *types* of verbal behaviors one emits. Meanwhile, current research indicates a difference between verbal and non-verbal behaviors. Verbal behavior, as we know, has a function to communicate between living organism, while non-verbal behaviors are behaviors reinforced through contacting the physical environment but with no apparent attempt to communicate (Skinner, 1957). As previously mentioned, Skinner states that for behavior to be verbal it involves the mediation of a listener and the listener can be another organism in the same verbal community or one's self (1957). Lodhi and Greer (1989) further define this phenomenon as self-talk. Self-talk occurs overtly or covertly; however, data are only collected across overt

emissions as covert self-talk cannot be observed. Furthermore, Greer, Pohl, Du, and Moschella (2017) suggests, "verbal behavior differs from a sole focus on language in that verbal behavior focuses on the *function* of communicating rather than the *structure* or the lexicon of communication" (p. 2). Although vocal verbal behavior contains lexical vocalizations, the focus of its emission is its function, not the structure. "This does not mean that structure is not a key feature of language. Rather, verbal behavior fills the gaps toward a more complete trajectory of language as social behavior" (R. Greer, personal communication, February, 2018).

Social Behavior as Verbal Behavior

Skinner's (1957) theory defines language by its function, controlling variables, reinforcing and punishing contingencies, and lastly, its extensive involvement with an audience. Skinner argues that verbal behavior is social behavior, as one comes in contact with social environmental contingencies. Likewise, Greer and Du (2015) argue that social behavior is in fact, verbal behavior; thus, declaring the terms "verbal" and "social" as synonyms of one another. Actively engaging as a listener and speaker with others by emitting and contacting the reinforcing contingencies of both parties is the foundational development of social communication and language. Verbal Behavior Developmental Theory (VBDT) further extends upon Skinner's theory by explaining the social contingencies of verbal behavior as seen in the independent listener and speaker responses as well as the joining of the two, whether between two organisms or within one's skin (Greer, 2008; Greer & Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009).

Independent Listener Behavior. Skinner (1957) refers to the audience within a verbal exchange, whether between two or more persons or between one's self when acting as both the listener and the speaker aloud (i.e., self-talk (Lodhi & Greer, 1989)). The listener plays multiple

roles in the emission of verbal behavior and is representative of observing or "perceptual" responses (Greer et al., 2017). First, the listener consequates the behavior of the speaker through generalized reinforcement. Reinforcement is delivered as a speaker response and the listener's response acts as the controlling variables of both the discriminative stimulus (Sd) and motivating operation (MO) for the initial speaker to emit a second response. Lastly, the listener's behavior is reinforced by the speaker's second response (Skinner, 1957).

Independent Speaker Behavior. When humans develop speaker repertories and are in the presence of a listener, the speaker manipulates environmental contingencies by calling on another individual, or the listener within his or her own skin, to mediate the surrounding environment (Skinner, 1957). These contingencies are mediated by emitting speaker verbal operants and relevant autoclitics to govern others or themselves (Skinner, 1957). Speaker operant behavior is an initiated response to a listener and each response following the listener's response(s) within rotated verbal exchanges. The initial speaker response acts as the discriminative stimulus for the listener to respond. Each speaker rotation thereafter acts as reinforcement for the listener's response and vice versa.

Bidirectional Operants. When the listener responds to the speaker as a speaker, a symbiosis relationship occurs between the two, in which, the listener and speaker intercept and a bidirectional operant is formed (Greer et al., 2017). The joining of listener and speaker responses occurs across three different categories: "(a) verbal episodes between persons, (b) the speaker as own listener (Donley & Greer, 1992; Greer & Speckman, 2009; Skinner, 1957), and (c) the learning of word-object relations as speaker and listener incidentally" (Greer et al., 2017 p. 2). In this study, the research focuses on the verbal episodes emitted between two or more

persons. Refer to Figure 1 for a visual analysis of a bidirectional operant occurring between persons.

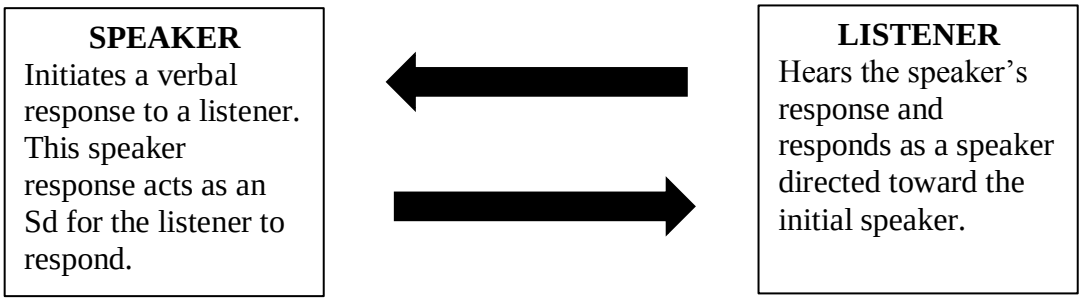

Figure 1. Listener and speaker responses as bidirectional operants.

Conversational Units. The bidirectional capabilities of the listener and the speaker are defined by the emission of verbal episodes (Skinner, 1957), or more specifically, conversational units between two or more persons (Donely & Greer, 1992; Greer & Keohane, 2005; Lodhi & Greer, 1989). A conversational unit is a verbal exchange in which, "a speaker responds to the presence of a listener with a speaker operant that is then reinforced by the listener" (Greer & Keohane, 2005 p. 39). The speaker and listener responses are exchanged between two beings or one's self (i.e., conversational units occurring aloud between one's self is referred to as self-talk).

The initiation of a speaker response and the listener's response to the speaker occurring within a conversational unit are separate measures of social reinforcement, as the emission of conversational units measures the reinforcement of verbal behavior between two people. The reinforcement of verbal behavior is evident in the exchange of verbal operants regardless if the verbal exchange "makes sense" (Greer et al., 2017). For example, one can have a conversation with someone without one party having knowledge of the topic; however, verbal operants were exchanged and reinforced as evident in the continuous emission of listener and speaker responses. VBDT expands upon the evolution of the bidirectional operant by comparing its

acquisition to a biological metamorphosis (Greer et al., 2017). This comparison explains how children functioning at the pre-verbal foundational level of verbal behavior are the caterpillars, in which their environment is restricted and bare; while the children with newly acquired bidirectional operants are the butterflies after their metamorphosis, accessing new reinforcing contingencies in their environment and learning in new ways (Greer et al., 2017).

Research in the development of verbal behavior suggests the acquisition of these vital social, higher-order operants leads to the induction of behaviors necessary for one to engage in social/verbal interactions (Eby & Greer, 2014; Greer & Du, 2015; Longano, 2008). The development and acquisition of these behaviors are addressed in the Verbal Behavior Developmental Theory (VBDT) (Greer, 2008; Greer & Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009). Refer to Figure 2 for a visual analysis of a bidirectional operant as a conversational unit between a listener and speaker.

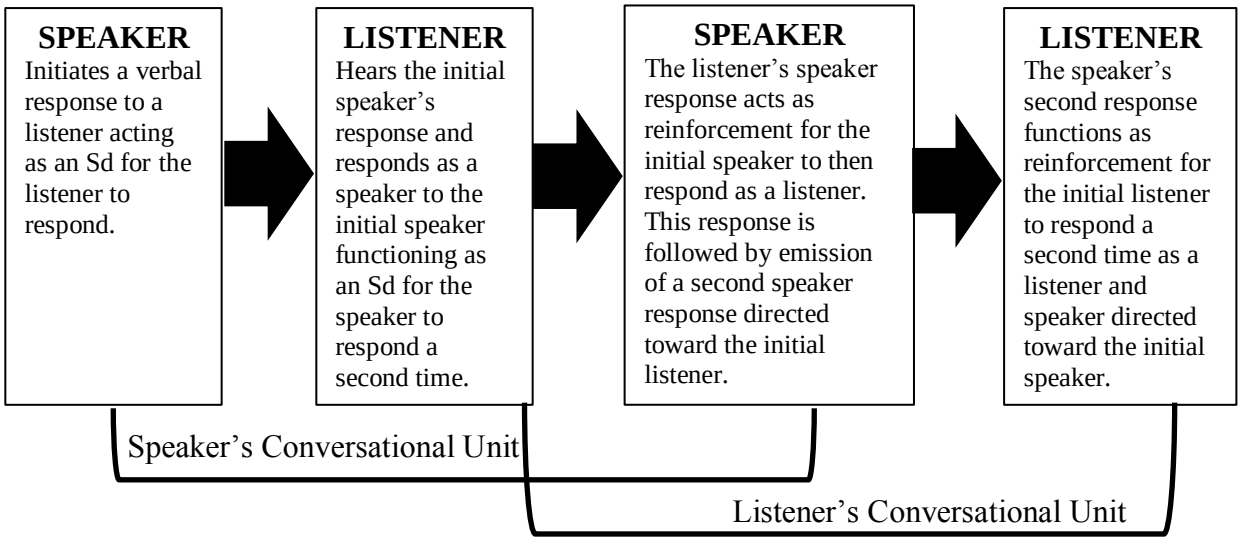

Figure 2. Bidirectional operants as conversational units.

Verbal Behavior Developmental Theory (VBDT)

VBDT combines Skinner's (1957) theory of verbal behavior with research in Stimulus Equivalence (1971, 1986, 1994); Relational Frame Theory (Hayes, Barnes-Holmes & Roche, 2001; Hayes & Hayes, 1989), and Naming Theory (Horne & Lowe, 1996; Greer & Keohane, 2005; Greer & Longano, 2010; Skinner, 1957) to propose a developmental trajectory of how one's verbal behavior develops over time (Greer, 2008; Greer & Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009). VBDT categorizes the behaviors acquired within each level of verbal behavior as either a behavioral cusp (Rosales-Ruiz & Baer, 1996) or a cusp as a new learning capability (Greer & Speckman, 2009).

Acquisition of behavioral cusps and learning capabilities allow children to contact new reinforcing or punishing environmental contingencies and learn in new ways (Greer & Speckman, 2009). VBDT focuses on determining the multiple sources of incidental language acquisition, expanding one's community of reinforcers (Bushell & Bear, 1994), and developing the necessary scientific protocols and tactics derived from the principles of behavior to induce any missing verbal behaviors (Greer & Ross, 2008). Most importantly, VBDT suggests identification of the stimulus control and ontogenetic sources of hypothetical constructs acknowledged in cognitive and developmental psychologies (Greer, 2008).

Assessing Levels of Verbal Behavior

Verbal Behavior Developmental Assessment-Revised (VBDA-R). The levels of verbal behavior are identified using the CABAS® VBDA-R (Greer, 2010). The VBDA-R is an assessment tool used to identify a child's level of verbal behavior as determined by the number of behavioral cusps and cusps as learning capabilities within his or her repertoire upon completion of the assessment. The VBDA-R aligns with verbal developmental trajectory

outlined in Greer and Ross (2009). Refer to Table 3 for a detailed outline of the verbal behavioral developmental cusps and cusps as learning capabilities across each corresponding level of verbal behavior. There are 37 verbal cusps measured on the assessment with each being worth 1 point with a maximum score of 37 on the assessment. Instructions for conducting the assessment are described in Greer and Ross (2009).

Table 3

Verbal Behavioral Developmental Cusps and Cusps as Learning Capabilities Across each Corresponding Level of Verbal Behavior

Levels of Verbal Behavior	Verbal Behavioral Developmental Cusps and Cusps as Learning Capabilities
Pre-Foundational	• Instructional control • Conditioned reinforcement for observing voices • Conditioned reinforcement for observing faces • Conditioned reinforcement for observing 2D and 3D stimuli • Capacity for sameness across the sense
Independent Listener	• Generalized imitation* • Generalized matching • Basic listener literacy • Auditory match-to-sample selection response
Independent Speaker	• Parroting • Echoic-to-mand • Echoic-to-tact • Independent mands • Independent tacts • Transformation of establishing operations across mands and tacts
Bidirectional (see *Note*)	• Say-do correspondence • Self- talk • Unidirectional Naming • Bidirectional Naming*
Foundational Reader and Writer	• Conditioned reinforcement for observing books • Naming accrues from listening to stories read aloud by others • Print transcription • Dictation
Basic Reader	• Textually responding to rate • Responding to own textual responses as a listener • Reading governs own responding • Textually responding joins the naming capability • Conditioned reinforcement for textually responding to printed stimuli
Basic Writer	• Joint stimulus control across saying and writing • Technical writing that precisely affects the reader's behavior • Aesthetic writing that affects the reader's emotions
Self-Editor	• Joining of the reader-writer cusps and capabilities
Verbally Mediated	• Textually responding to complex operations • Technical writing to govern the complex operations of others

Note. * Represents cusps as learning capabilities. Bidirectional Level of VB was formally known as the speaker-as-own-listener level of verbal behavior and represents the joining of the independent listener and speaker repertoires. I suggest we adopt the tact *bidirectional* from Miguel (2016) to represent this level of verbal behavior as it is a more concise yet all-encompassing description of the capability.

CABAS® International Curriculum and Inventory of Repertoires for Children from Pre-school through Kindergarten Fifth Edition (C-PIRK). The C-PIRK is used as a criterion-referenced assessment and curriculum (Greer, 2013). The C-PIRK measures foundational repertoires necessary for children to access kindergarten independently as seen in normative educational settings; while, teaching those repertoires when missing using learn units and instructional demonstration learn units (IDLU) (Albers and Greer, 1991; Hranchuk, 2016). The C-PIRK addresses numerous skills, that once acquired, establishes the foundation for the next skill in a hierarchal fashion.

The C-PIRK tool is used in the Comprehension Application of Behavior Analysis to Schooling (CABAS®) model to assess and teach neuro-typically and neuro-atypically developing preschoolers (Greer, 2013). Specifically, research demonstrates the effectiveness of the C-PIRK as a teaching curriculum to prepare children diagnosed with ASD for mainstream education (Waddington & Reed, 2009). The results of the study showed the participants who received instruction from the C-PIRK curriculum demonstrated improvement in the areas of behavior management and social skills when compared to the control group. Refer to Table 4 for a detailed outline of the C-PIRK domains and corresponding repertoires.

Table 4

C-PIRK Domains and Corresponding Repertoires

Domains	Repertoires
Academic Literacy	*Academic Equivalence* • Matching for sameness • Reading/writing sameness to equivalence • Textually responding and comprehending • Numeric sameness to equivalence • Number skills • General knowledge (i.e., tacting items in various categories (e.g., animals, transportation, flowers), calendar skills, community helpers, etc.) • Common multiple control intervaerbals • Worksheet skills *Communication* • Listener behavior • Speaker behavior • Social intraverbals
Community of Reinforcers	Educationally significant reinforcers in a child's environment (e.g., observing books, building blocks, coloring, etc.).
Self-Management Skills	*School Sufficiency* • School routines • Self-help skills *Social Repertoires*
Physical Development	*Small Muscle Movement* • Grapho-Motor Skills • Classroom Tools/Manipulatives *Large Muscle Movement*

Educational Assessments

Autism Diagnosis Observation Schedule-Second Edition (ADOS-2). The ADOS-2 is an assessment tool used to measure a child's severity of autism (Lord, Rutter, DiLavore, Risi, Gotham, & Bishop, 2012). Researchers outside of the behavioral analysis and verbal behavior

fields developed this instrument to measure social-communication skills as well as restricted and repetitive behaviors for individuals of all ages (i.e., toddlers to adults). The ADOS-2 is administered across one of four modules to accommodate varying levels of expressive language skills (i.e. verbal behavior). Specifically, Module 1 is used for individuals with little to no vocal verbal behavior while Modules 3 and 4 were used for individuals with advanced expressive language skills. Module 3 targets children by incorporating imaginative play skills and Module 4 targets teens and adults with a more age-appropriate focus. An individual's ADOS-2 score determines the range of autism severity across a spectrum based on the module used: No evidence (1-2), low (3-4), moderate (5-7), or high (8-10). For instances, a high score on the lowest module represented a child functioning on the higher end of the autism spectrum, and therefore had fewer communication and social skills. A child with a low score on the highest module functioned on the lower end of the autism spectrum, and therefore had more communication and social skills in his/her repertoire.

Vineland-3 Adaptive Behavior Scale-Third Edition (VABS-3). The Vineland-3 is an educational assessment tool used to diagnose individuals with intellectual and developmental disabilities from birth to 90-years-old (Sparrow, Cicchetti, & Saulnier, 2016). It is designed to accommodate any adaptive behavior need through various avenues of completing the assessment (e.g., parent/teacher interviews and forms, electronic and abbreviated versions). The Vineland-3 targets the assessment of: communication skills (receptive, expressive, and written); daily living skills (personal, domestic, and community); socialization skills (interpersonal relationships, play and leisure, and coping skills); motor skills (fine and gross motor); and maladaptive behaviors (internalizing and externalizing). The Adaptive Behavior Composite Score on the Vineland-3 range as follow: borderline adaptive functioning (70-80); mildly deficient adaptive functioning

(51-55 -70); moderately deficient adaptive behavior (35-50); severely deficient adaptive behavior (20-35); profoundly deficient adaptive behavior (< 20). Scores above 80 are classified in a similar manner as IQ scores (i.e., low average, average, above average, superior).

There is currently no research to-date demonstrating a relationship, or lack thereof, between the VBDA-R, C-PIRK, ADOS-2, and VABS-3. This field of research could be necessary in assisting the verification of the verbal behavior assessments used in CABAS® with outside disciplines. Specifically, if a relationship was shown between the assessments, educators would have the freedom to use the results interchangeably to assist in educational placements and provide a clearer picture of the child's social-communication skills.

Social/Verbal Behavior Between Mothers and Their Children

The Need for Social Interactions

As previously discussed, VBDT suggests how in the early stages of life children acquire pre-verbal foundational repertoires such as conditioned reinforcement for observing voices, faces, and various environmental stimuli (Greer & Keohane, 2005; Greer & Ross, 2008; Keohane, Pereira-Delgado, & Greer, 2009). These "early stages of life" begin in utero. DeCasper and Fifer (1980) discovered that newborn infants preferred the sound of their mother's voice to other females, males, as well as their father's voice. The experimenters tested the infants' voice preference shortly after birth by comparing the number of sucks emitted while listening to their maternal voice read a story and, a non-maternal voice read the same story.

Central to the discipline of verbal behavior, mother-child bonding is explained across the infant's acquisition of his first conditioned reinforcer: In utero, the mother's voice is paired with the essential provisions; air, food, and body heat to condition the mother's voice as a reinforcer for observing responses. The infant contacts the reinforcing contingencies of hearing his/her

mother's voice when paired with feeding and attention; thus, in utero, the mother's voice becomes the first conditioned reinforcer (Greer, 2008; Maffei, Dudek, & Keohane, 2014). Greer (2008) clarifies this phenomenon is a factor of the phylogenetic contribution as proposed by Skinner (1975) (i.e., organisms may or may not acquire some behaviors due to the organism's predisposed genetic makeup). Upon acquisition of conditioned reinforcement for listening to the mother's voice, after birth, her voice is then paired with other voices and faces in the child's environment resulting in the acquisition of conditioned reinforcement for observing voices and faces. Having these cusps in one's repertoire builds upon the foundation for subsequent learning and social interactions.

Positive and Negative Effects of Mother Interactions

Current literature supports a positive effect of skin-to-skin contact between mothers and their newborn infants directly after birth and the mother's sensitivity toward the child, infant's self-regulation, and reciprocity between the dyads at one year after birth (Bystrova, Ivanova, Edhborg, Matthiesen, Ransjö-Arvidson, Mukhamedrakhimov, Moberg, & Widström, 2009). Regarding the biological effects of mother-child interactions, Feldman, Gordon, Schneidernman, Weisman, and Zagoory-Sharon (2009) tested the levels of oxytocin in infants before and after affection was delivered from their mother. The results demonstrated an increase in oxytocin levels after the child received affection (i.e., approvals in the form of eye contact, touch, hugs, and kisses), while the change was not reported in the children who did not receive affection. From a behavioral perspective, the chemical reaction of this hormone is a biological by-product of contacting social reinforcement (i.e., mother's affection/approvals and observing their mother's face).

Alternatively, research supports the negative influence mothers play on aversive social interactions with their child. Specifically, reported evidence of mothers who encountered high aversive interactions with adults emitted significantly more aversive interactions (i.e., disapprovals) with their child on the same day (Dumas, 1986; Wahler & Fox, 1980). Patterson's (1982) Coercion Theory explains how a mother's aversive behaviors negatively reinforces her child's aggressive behaviors. The theory suggests that due to the coercive cycle, children demonstrate and internalize aggressive behaviors learned from their family with people in their community (Patterson, 2016; Smith, Dishion, Shaw, Wilson, Winter, & Patterson, 2014).

Recent research suggests that positive maternal support may result in a reduction of children's problem behaviors and mother's harsh parenting overtime (Lunkenheimer, Ram, Skowron, & Yin, 2017). Similarly, research findings indicate that when mothers and children both employ emotional-regulating strategies during sessions of mother-child joint engagement, children decreased their expression of negativity while mothers increased their emotional and motivational support (Gulsrud, Jahromi, & Kasari, 2009). The findings across positive and negative mother-child interactions further support the argument that children considerably benefit from positive maternal interactions. These day-to-day interactions between children and their caregivers can play a significant role in the survival, growth, and mental development of children (World Health Organization, 2004).

Effects of Mother Interactions on Social/Verbal Development

Specific to the social and verbal development of children, *what* type of positive maternal interactions play a significant role and *how* do these interactions affect the child's verbal development? The World Health Organization (WHO) developed the *Programme for the Enrichment of Interactions between Mothers and Their Children* as a prevention and intervention

tool to increase psychological development in children (1997). The programme listed "Eight Guidelines for Good Interactions" and three of the guidelines suggests: (1) talk to your child through means of expressions, gestures, and sounds, (2) follow your child's lead, (3) and praise your child (i.e., deliver approvals). Bromwich's (1990) Parent-Infant Interaction Model reported how a mother's sensitive and specific observation of her child assists in the parent "reading and responding" (i.e., listening to the child's verbal behaviors and emitting a speaker response) and enhances the development of play and language as well as the overall quality of the parent-infant interactions.

Acquisition of Joint Attention and Observing Responses

Before words are exchanged, cognitive-developmental psychologists explain the acquisition and role of joint attention between infants and their mothers. Bruner (1981) first described joint attention as, "the impelling force behind early indicating forms of communication" (p. 162). Joint attention is demonstrated around 9-12 months of age and is defined as a child emitting the behavior of pointing to an object and showing an object to another person (i.e., initiating joint attention (IJA)), in addition to, the child alternating eye gaze between an interesting object and a person to share an experience (i.e., responding to joint attention (RJA)) (Mundy, Block, Delgado, Pomares, Vaughan Van Hecke, & Parlade, 2007; Mundy, Sigman, & Kasari, 1990; Tomasello, 1995; Tomasello & Farrar, 1986). More specifically, Tomasello's (2008) usage-based theory explains three basic human motives of communication to be the requesting of others (imperative), helping others (declarative as informative), and the sharing of feelings (declarative as expressive). These early signs of human communication can be seen in infant pointing and pantomiming around the first year of life (Tomasello, 2008). Bruner's work also explained how this skill begins with the emission of eye-to-eye-contact

between the child and the mother. Recent empirical evidence supports Bruner's theory demonstrating the early acquisition of visual attention (at 1 month) is a precursor for early acquisition of joint attention (at 12 months) (Salley, Sheinkopf, Neal-Beevers, Tenenbaum, Millier-Lincar, Tronick, Lagasse, Shankaran, Bada, Bauer, Whitaker, Hammond, & Lester, 2016).

From a behavioral perspective, Skinner (1984) explains how organisms behave in certain ways as a result of contacting either contingencies of survival (e.g., removing hand from hot burner) or contingencies of reinforcement (e.g., infants learning to crawl to contact new contingencies in their environment (Rosales-Ruiz & Baer, 1997)). As infants acquire conditioned reinforcement for observing their mother's voice in utero and the voice is then paired with observing their mother's face after birth, the infant's second conditioned reinforcer emerges (Maffei-Lewis et al., 2014). Acquisition for conditioned reinforcement for observing faces is the point at which eye-to-eye contact emerges. Conditioned reinforcement for observing voices and faces leads to conditioning the observation of environmental stimuli such as 2D and 3D stimuli (Keohane, Luke, & Greer, 2008; Keohane, Pereira-Delgado, & Greer, 2009).

In addition to reinforcement, multiple stimulus control plays a role in the acquisition of observing responses (and all subsequent behaviors). Stimulus control occurs when observing responses emitted across the senses contact antecedent environmental stimuli (i.e., 2D and 3D stimuli) and these stimuli are then paired with conditioned reinfrocers (i.e., voices, faces) resulting in an increased probability of control over the operant response (Cahill & Greer, 2014; Dinsmoor, 1983, 1985, 1995; Keohane et al., 2008). The reinforcing contingencies of observing responses can be explained in that once the infant is reinforced by observing his mother's face or

making eye contact, the emission of joint attention between the dyad and environmental stimuli emerges.

Early Acquisition of Language

Greer (2008) explains the phenomenon of conditioning observing responses and their role in the acquisition of language: as response classes are initially independent of one another, the development of language involves the joining of observation and production responses. The author states, "these initially independent response classes become joined as a result of certain outcomes made possible by natural selection and behavior selection of cultural outcomes" (p. 370). The four basic cultural outcomes of observing responses are – dance, music, visual arts, and verbal behavior. Visual and auditory stimuli are conditioned as reinforcers, and the behaviors of see-do (e.g., dance) and hear-do (e.g., music) develop into automatic reinforcers after multiple exemplar experiences of these behaviors; and these behaviors are necessary for one to produce speaker behavior (see Greer (2008) for a more detailed explanation of this phenomenon).

Having the behavior of observing responses across the senses within one's repertoire is the critical and foundational element of language function as they, "represent the first instances of the joining of the listener and speaker repertoires" (Keohane et al., 2008, p. 24). VBDT refers to the joining of the originally independent behaviors as the bidirectional naming capability and is the point at which children acquire language incidentally (Greer et al., 2017; Horne & Lowe, 1996; Miguel, 2016). Specifically, Longano and Greer (2014) explain how the auditory and visual observing responses are the sources for acquisition of this indispensable capability of word-object relations; thus, listening to the echoic response or name of the object while simultaneously looking at the object results in the joining of the listener and speaker repertoires.

The foundational operant behaviors of observing pave the way for the acquisition of higher order verbal operants that then lead to the development of verbal behavioral cusps and learning capabilities and the emission of more complex verbal behavior (Cahill & Greer, 2014; Keohane et al., 2009).

Hart and Risley (1995) explained how children begin to learn words (i.e., vocal verbal behavior) during the first two years of life, the time at which they are with their parents the most. Tomasello's social-pragmatic theory of word learning (2000) suggests that children learn words and linguistic symbols through social-cultural conventions of learning adult's intentions through joint intentionality. This shared attention with others consists of following gaze directions, imitating actions, and redirecting attention through pointing. The use of social-pragmatic cues allows children to indicate the adult's intended referent, and in-turn, learn words through non-ostensive pairings (Tomasello, 2000). His theory explains that children use a variety of cues to "read" [the listener] the communicator's [the speaker] referential intentions through intentional reading. The stored exemplars of utterances [the speaker] are the fundamental unit of intentional action and the acquisition of language.

Tomasello's theory of imperative and declarative (both expressive and informative) joint intentions can be explained from a behavioral perspective as mands and tacts respectively. Mands exemplify social contract functions while tacts are representative of social contact with one's environment; and thus, are deemed critical for collaboration and survival of the species (Greer & Du, 2015). Ultimately, Tomasello is describing phenomena that are conclusively explained by the VBDT (Greer, 2008; Greer & Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009). Specifically, the emission of sequlics (Skinner, 1957; Vargas, 1982) and conversational units (Lodhi & Greer, 1989) as the recipient or listener volleys with the

communicator or speaker. The usage-based theory and social-pragmatic theory grasps the basis of communication; however, the key component that VBDT identifies is the role stimulus control plays on one's "joint intentionality."

Tomasello and Todd (1983) first documented the effects of joint attention between mother-child dyads on the child's lexical development. Specifically, the authors found that when mothers redirected the child's attention to an object, the child learned more object labels (i.e., tacts) and when the mother followed the child's attention, the child learned more personal-social words (i.e., words used to engage in greetings and gratitude). Regardless of the type of words the children acquired, the findings exaggerate the role joint attention, either a mother bringing her child into her attentional frame or following the child's attention, plays during this imperative verbal developmental stage in a child's life. Recent investigations continue to support the notion that joint attention between child and caregiver can have an impact on early lexical acquisition (Kristen, Sodian, Thoermer, & Perst, 2011; Markus, Mundy, Morales, Delgado, & Yale, 2000; Williams, 2016). Lastly, children between the ages of 1-3 were reported to join the attention of their parents more often than that of their peers (Nino, 2016); therefore, further supporting the weight *parent* roles play in their child's acquisition of language.

Mother's Vocalizations and Language Acquisition

In addition to emissions of mother-child joint attention and observing responses, mothers' frequent and distinct verbal stimulation plays an imperative role children's language development in terms of frequency of vocalizations and language skills (Snow, 1972; Clarke-Stewart, 1973). A 9-month longitudinal study on mother-child interactions revealed that children's competence levels in relation to language were highly related to a single mother variable, verbal stimulation (Clarke-Stewart, 1973). The results indicated a significant positive

correlation between the amount of verbal stimulation emitted by the mother and the child's social and communication skills.

Recent literature continues to suggest the crucial role of mother's language. Specifically, Goldstein, Schwade, and Bornstein (2009) investigated parent responsiveness on 5-month-old infants' salient social signals in the form of noncry vocalizations on the production of speech patterns. Pertinent to the types of parent language, research indicates, (a) the quantity of language used during the second year of life, (b) the diverse and sophisticated vocabulary used in the third year of life, and (c) the decontextualized language used in the fourth year of life, reflect the use and knowledge of children's vocabulary (Rowe, 2012). There is also empirical evidence supporting the quality and clarity of mothers' speech patterns directed toward their children may influence infants' speech discrimination skills and early language learning (Liu, Kul, & Tsao, 2003).

Skinner's (1938) concept of reinforcement explained in the functional analysis of operant learning is the contributing factor of how children acquire language through social interactions with their mothers and exposure to her vocalizations. Skinner explains that reinforcement occurs when a stimulus change immediately follows a response and as a result, increases the frequency of that behavior, under similar conditions, in the future. Research on Skinner's operant conditioning explains a behavioral perspective of how a systematic increase in the rate between the parent-child interactions due to the listener and speaker contacting the reinforcing contingencies of one another, results in a bi-directionality of reinforcement effects (i.e., a bidirectional operant is formed) (Gerwirtz & Pelaez-Nogueras, 1992; Greer et al., 2017).

Additional literature demonstrates that mother's vocal imitations of their infant's vocalizations functioned to reinforce the infant's vocalizations (Pelaez, Virues-Ortega, &

Gewirtz, 2011b). Specifically, the same authors tested the type of reinforcement and form of vocalizations used to increase infant vocalizations. The results revealed contingent vocal imitation and motherese speech functioned to reinforce infant vocalizations over non-contingent reinforcement (Pelaez, Virues-Ortega, & Gewirtz, 2011a). Although the listener and speaker rotations that occurred in this study were not comprised of lexicons, the vocalizations rotated between the dyads were reinforced nonetheless. As mothers reinforce their child's verbal behavior and vice versa, the result is an increase in their social/verbal interactions over time.

Demographic Factors on Mother-Child Interactions and Language Acquisition

If infants are born with the social preference for their mothers, what environmental factors have an adverse effect on the progression and positive reinforcement of mother-child social interactions? To date, research supports the notion that various demographic characteristics such as level of education, household income, and a combination of factors across one's socio-economic status (SES) may have an adverse effect on theses interactions and the child's acquisition of language.

Specifically, Tulkin and Kagan (1972) found that mothers' verbal behavior (the authors use the term "verbal" to mean "vocal") with their 10-month-old infants differed among income levels. The results showed a higher indication of vocal verbal behavior emitted by mothers with a median income when compared to mothers with a lower income. Rowe (2008) tested if child-directed speech with parents predicted the production of child vocabulary skills following a year. The results indicated child-directed speech with parents was an indicator of the acquisition of vocabulary skills. Also, the results showed a relationship between child-directed speech and both parent income and level of education. The literature supports differences across SES levels on mother-child interactions and the child's acquisition of language. Specific differences were

shown between the children in the middle and high-SES groups, in which, the high-SES group had a greater increase in vocabulary following a 10-week period (Hoff, 2003). The author argues the difference in language acquisition is due to children having different language experiences with their mothers, or lack thereof, across the varying levels of SES.

The longitudinal study conducted by Hart and Risely (1995) examined the defects of parent interactions and social economic status (SES) on the language development of children across a two-year time span. The results reported a difference of 30-million words heard by children between ages 1-4 years old from lower SES backgrounds. When the same children were reexamined in the third grade, the children who were exposed to more words had a higher vocabulary growth, vocabulary use, and IQ score. The Thirty Million Word Initiative (Suskind, Suskind, & Lewinter-Suskind, 2015), derived from Hart and Risley (1995) findings, suggest *all* parents follow the three Ts of communication to assist in the development of their child's language skills and decrease the educational achievement gap: Tune in to what your child is doing; Talk more to your child, and Take turns engaging in conversations with your child.

The Development of Children with ASD and its Effects on Language Acquisition

Research indicates mother-child interactions and demographical factors can play a significant role in the verbal behavior development of neuro-typically children. What about language acquisition for neuro-atypically developing children, such as, children with ASD? What leads to children being diagnosed with ASD and how do they develop neurologically, cognitively, and verbally? Lastly, what role do these combinations of factors play in language development and mother-child social interactions?

Neurological Development

Using brain mapping techniques, neuroscientists have localized the differences in brain development for children with ASD compared to neuro-typically developing children during the first year of life (Courchesne, Pierce, Schumann, Redcay, Buckwalter, Kennedy, & Morgan, 2007). The results revealed early brain overgrowth is a key factor in the pathobiology of autism. Overgrowth of the brain occurs during the first 6-14 months of life (Courchesne, Carper, & Akshoomoff, 2003) and was found to be a result of excessive neurons that produced defects in neural patterning and wiring (Courchesne et al., 2007). The deficits indicated a high level of local and short-distance cortical activity that can obstruct the function of large-scale, long-distance interactions between different parts of the brain such as frontal, temporal, and parietal cortices (Courchesne et al., 2007). These large-scale networks of the brain are the underpinnings of socio-emotional and communication functions thus physiologically explaining deficits demonstrated in children diagnosed with ASD.

Cognitive Development

In cognitive-developmental psychology, research chronologically follows the neurological effects of ASD, indicating that social deficits in children with ASD begin before 18 months of age (Sigman, Dijamco, Gratier, & Rozga, 2004). Sigman and colleagues identified the core deficits of ASD as early detectors of the developmental disorder. The core deficits are defined as dyadic interaction and imitation that typically develop around 3-6 months of age, emotion discrimination around 4-7 months, and attachment to familiar caregivers around 8-10 months of age.

Additional support for neurological findings by cognitive-developmental psychologists between children with ASD and their neuro-typically developing peers is outlined in the differences across engagement in social interactions and the development of language. Specific

to dyadic interactions and imitations, Adamson and colleagues indicated that children who screened at-risk and children diagnosed with ASD had poorer joint attention and engagement skills during parent-child interactions. In addition, the lack of joint *engagement* was a predictor of late development of expressive vocabulary in children with ASD when compared to joint *attention* skills; however, future research provided that joint engagement skills improved distinctly with parents once the children began speaking or emitting vocal verbal behavior (Adamson, Bakeman, Suma, & Robins, 2017).

The research findings discussed between children with ASD and their neuro-typically developing peers across joint attention skills support seminal findings indicating the differences between children with ASD and children with other developmental disabilities; and the deficits in gestural joint attention have reportedly affected language acquisition (Loveland & Landry, 1986; Mundy & Signman, 1989; Mundy, Sigman, & Kasari, 1990). Research suggests that joint attention and symbolic play interventions may influence an increase in expressive language skills for children with ASD. The results indicated significant gains in language outcomes using the joint attention intervention over the symbolic play intervention for children who began with the lowest language skills; therefore, further supporting the imperative role joint attention plays on the acquisition of language in children with ASD (Kasari, Paparella, Freeman, & Jahromi, 2008).

In line with gestural joint attention, Mundy, Sigman, Ungerer, and Sherman (1986) found deficits in non-verbal communicating (non-vocal verbal) behaviors across children with ASD. Specifically, Stone, Ousley, Yoder, Hogan, and Hepburn (1997) found children with ASD used non-verbal (non-vocal verbal) behaviors for the purposes of requesting items more often than for the purpose coordinating other's attention. Research supports that the requesting of items (i.e.,

manding) is verbal behavior, thus, social behavior (Eby & Greer, 2017). The results of both studies suggest children with ASD may use non-vocal verbal behaviors to communicate.

Verbal Behavior Development

The reported research findings attempt to explain the lack of eye gaze, orientation, joint attention, and social interactions with others in children with ASD along with the need to induce these essential skills to assist in the development of language skills. As previously discussed, VBDT explains the evolution of verbal behavior across a developmental trajectory. In conjunction, VBDT seeks to provide a scientific behavioral perspective explaining the lack of such skills for children with ASD and other developmental disorders. Greer (2008) explains how not having conditioned reinforcement for observing responses within one's repertoire is a result of missing ontogenetic selection of verbal behaviors beginning in utero. Missing these key psychological components results in the lack of acquisition for sequential observing responses after birth, acquisition of higher order verbal operants, and so forth.

Greer (2008) explains, "… the environment selects verbal behavior and… the phylogenetic capacity for operant and respondent conditioning eventually makes the cultural functions of language possible" (p. 364). Skinner (1975) suggests that new stimulus control can shape phylogenetic behaviors due to organisms behaving accordingly in the presence of the certain stimuli. As a result, VBDT developed (and continues to develop) explicitly designed protocols for preschool children with ASD to acquire the necessary behavioral cusps and cusps as learning capabilities to expand one's verbal behavior repertoire (Greer & Ross, 2008). The protocols used to induce missing verbal behaviors in children with ASD and other language or developmental delays are described accordingly:

Conditioned reinforcement for observing faces, voices, 2D and 3D stimuli are induced using strategic conditioning protocols such as stimulus-stimulus paring procedures (Greer, Pistoljevic, Cahill & Du, 2011; Keohane et al., 2009; Maffei-Lewis et al., 2014). Acquisition of generalized imitation, generalized matching, auditory selection response, and listener literacy build listener repertoires necessary to begin communication with others, imitate others' actions, discriminate sounds heard, and, follow vocal directions. These behaviors are induced through various protocols such as listener emersion and auditory matching (Choi, Greer, & Keohane, 2015; Delgado, Greer, Speckman, & Goswami, 2009; Du & Greer, 2014; Greer, Chavez-Brown, Nirgudkar, Stolfi, & Rivera-Valdez, 2005).

Speaker repertoires such as echoic behavior, independent mands and tacts, and the transformation of establishing operations between the two are necessary for one to emit spontaneous speech and foundational speaker responses. These repertoires are induced through protocols such as rapid motor imitation and intensive tact procedures (Greer, Nirgudkar, & Park, 2003; Pistoljevic, 2008; Tisouri & Greer, 2003). As the listener and speaker join into speaker-as-own-listener repertoires, bidirectional naming is induced (Horne & Lowe, 1996; Longano & Greer, 2010; Greer et al., 2017) through various strategic procedures such as multiple exemplar instruction (MEI) and intensive tact (Gilic & Greer, 2011; Pistoljevic, 2008). Finally, acquisition of conditioned reinforcement for socially listening to others, audience control, and learning through the observation of others is an imperative behavior necessary for social development. These social behaviors are induced through, adult praise, social listener reinforcement and observational learning procedures (Baker, 2014; Schmelzkopf, Greer, Singer-Dudek, & Du, 2017).

Mother-Child Interactions

Although children with ASD have numerous contending factors to address, and as a result may require numerous learning opportunities and specifically designed protocols to acquire verbal repertoires compared to their neuro-typically developing peers, the need for these social/verbal interactions with their mothers are no less important. Early investigations compared the parent-child interactions of neuro-typically developing children and children with ASD. Results indicated children with ASD directed as much attention to their caregiver in the form of looking, vocalizing, and proximity of behaviors toward their caregiver as the control group did. The results suggested children with ASD attempted to interact with their parents as often as their neuro-typically developing counter parts (Sigman, Mundy, Sherman, & Ungerer, 1986).

In conjunction, a longitudinal study on parent behavior toward their children diagnosed with ASD during play interactions showed that parents synchronized their behaviors to their child's attention and activities as much as parents of neuro-typically developing children (Siller & Sigman, 2002). More importantly, the results indicated superior joint attention and language skills emerged over 1-, 10-, and 16-year periods for the children with ASD whose parents synchronized their behaviors with theirs more often. The same authors conducted a different study supporting their previous findings. The results suggested that parents' rate of language growth in children with ASD was independently predicted by the child's responses to the joint attention of others, and the parent's responsiveness to their child's attention and specific activity engagement during play (Siller & Sigman, 2008). McDuffie and Yoder (2010) found that the specific type of verbal responsiveness emitted by the parents that played a predictive role in language outcomes for children with ASD. The findings revealed both the parent's verbal utterances that followed the child's focus of attention and the parent's response to his/her child's

verbal communication independently suggested the direct facilitation of early language acquisition. These results were interpreted on the use of parents providing attention following learning new words as word-learning strategy for children with ASD (i.e., positive reinforcement).

Researchers have investigated interventions for parents of children with ASD and developmental delays to increase their responsiveness and communication and the effects that these interventions have on language development. For infants, the Pelaez et al., (2011a) findings supported the contingent reinforcement of infant vocalizations by mothers using vocal imitations increased infant vocalizations. The authors argued this explicit maternal interaction may be used as a practical and effective early intervention procedure for infants with developmental delays. Siller, Hutman, and Sigman (2013) used a Focused Playtime Intervention (FPI) to enhance the parents' specific communication and verbal responses to their child. A 1-year follow-up indicated a direct conditional effect of FPI on the expressive language outcomes of children with ASD whose communication skills presented below 12 months of age. The literature reviewed across interventions for parents of children with ASD demonstrates an effective attempt to diminish the educational achievement gap between children with ASD and their neuro-typically developing peers.

Research supports the notion that children are born observing and contacting the stimulus control of their mothers' voice over others. As children develop, these vital interactions are instrumental to the success of their social/verbal developmental repertoires. For children with ASD, social/verbal interactions with their mothers are even more invaluable thus calling for an empirical investigation focusing on the vocal and non-vocal verbal behaviors emitted between children and their mothers. Conducting such an investigation can assist in determining the vital

avenues necessary for mothers to further cultivate their child's *verbal behavior* development.

Rationale for Current Study

The rationale for conducting the current study on the vocal and non-vocal verbal behaviors emitted between preschool children diagnosed with autism and their mothers is to answer the following research questions: Are there relationships between a child's level of verbal behavior and various educational assessments? Are there relationships between the verbal behaviors emitted by the child with the mother during free-play sessions across the child's level of verbal behavior and educational assessments? Are there any relationships between the mother's emission of verbal behavior across the child's level of verbal behavior and the mother's demographic variables?

Chapter II

Method

Participants

A preschool that implemented the Comprehension Application of Behavior Analysis to Schooling (CABAS®) model notified approximately 208 parents with a recruitment letter titled "Improving Parenting and Enhancing Maternal Wellbeing in Mothers of Preschool Children." Forty-six of the mothers notified responded to the letter with the final sample size consisting of 35 mother-child dyads. Experimental attrition can be explained as follows: (1) video data on four dyads were lost, (2) two dyads moved away, (3) one child did not qualify as having ASD, and (4) to control for translation errors, two dyads were excluded from the final sample as they spoke in their native non-English language during the recorded session.

Each dyad consisted of a child between the ages of two to five years of age and his or her biological mother. Each child was diagnosed as either a preschooler with a disability or had previously received a specific medical diagnosis. Regardless of the child's medical diagnosis, each participant was given an ADOS-2 severity score (Lord et al., 2012). Two of the 35 participants did not have an ADOS-2 score available but did have a comparable CARS-2 score. Table 5 contains relevant demographic characteristics of the child sample, including gender, age, IEP, and ADOS-2 severity score. Table 6 contains relevant demographic characteristics of the mother sample including, age, race, level of education, and household income.

Table 5

Demographic Characteristics of Child Sample

Variable	*N*	Percentage
Gender	M = 27 F = 8	M = 77.1% F = 22.9%
Age	2 years = 3 3 years = 11 4 years = 12 5 years = 9	2 years = 8.6% 3 years = 31.4% 4 years = 34.3% 5 years = 25.7%
IEP	Yes = 35 No = 0	Yes = 100% No = 0%
ADOS-2 Severity Score	Low = 3 Moderate = 13 High = 17 CARS-2 = 2	Low = 8.6% Moderate = 37.1% High = 48.6% CARS-2 = 5.7%

Note. The CARS-2 assessment was administered to two children who moved away before receiving the ADOS-2.

Table 6

Demographic Characteristics of Mother Sample

Variable	*N*	Percentage
Age	25-30 years = 2 31-35 years = 16 36-40 years = 12 41-50 years = 5	25-30 years = 5.7% 31-35 years = 45.7% 36-40 years = 34.3% 41-50 years = 14.3%
Race	White = 15 Hispanic = 9 African American = 7 Asian = 3 Missing = 1	White = 42.9% Hispanic = 25.7% African American = 20.0% Asian = 8.6% Missing = 2.9 %
Level of Education	GED = 2 No Bachelors = 6 Bachelors 14 Graduate = 12 Missing = 1	GED = 5.7% No Bachelors = 17.1% Bachelors = 40% Graduate = 34.3% Missing = 2.9%
Income	$10,000 - $49,999 = 9 $50,000 – $74,999 = 10 $75,000 - $99,999 = 11 $100,000 – $200,000 = 5	$10,000 - $49,999 = 25.7% $50,000 – $74,999 = 28.6% $75,000 - $99,999 = 31.4% $100,000 – $200,000 = 14.3%

Settings & Materials

The previously recorded mother-child sessions were conducted in a small isolated room located within a preschool. The room had two windows, one looking out to the street which was covered, and one two-way window directed toward the school hallway. Each session was recorded using two cameras, one front- and one back-facing camera. Inside the room was a small desk, two chairs, and a soft gym mat placed on the floor. The experimenters provided various toys for the free-play session that consisted of crayons, coloring books, a magna doodle, a play phone, dolls, toy cars, and a ball. Refer to Appendix A for an image of the free-play setting. All interactions took place on the mat, at the desk, or standing in the room. The experimenters used a timer to record the duration of each 5-min session.

The video data collection procedure took place in a secure separate room on a university campus. The room had two computers containing access to all participant videos with tables and chairs. The experimenter used a data sheet and a pen to record each occurrence of verbal behavior between the mother and the child. Refer to Appendix B for an example of a completed data sheet.

Procedure

Pre-recorded Video Assessment Procedure

The mother-child interaction sessions consisted of five, 5-min tasks that occurred across a 25-min session: 1) competing demands task, 2) teaching task, 3) free-play task, 4) clean-up task, and 5) a frustration task. Each task was recorded in real time and reviewed at a later date. The present study specifically selected the free-play task to analyze, as it provided a variety of activities for the dyads to select and zero guidelines, restrictions, or distractions. For example, during the competing demands task, the mothers were kept busy completing a survey while an inaccessible iPad was "left behind" by the experimenter as a second competing demand. During the teaching task, the mothers were required to teach their child how to build a specific block structure. The clean-up task required the child to clean-up the toys without any assistance from the mother. The frustration task consisted of an experimenter providing the child with a preferred edible and a second experimenter immediately taking it away in attempts to frustrate the child. Since the free-play task had no such restrictions, the dyads were provided with endless opportunities to socially engage and communicate.

The free-play task was conducted as follows: With the experimenter, mother and child in the room, the video recording began. Upon conclusion of the teaching task, the experimenter entered the room with a bag of toys and laid them out on the mat while naming each one. The

experimenter gave the direction, “Play with the toys for a little while.” The experimenter then left the room and started the timer for 5-min. Upon conclusion of the free-play task, the experimenter entered the room and handed the mother a note indicating the free-play task had ended, and the clean-up task was to begin.

Target Responses and Measures

The social interactions were defined by the emission of verbal behavior exchanges that occurred between the mother and the child during the free-play sessions. Each exchange involved an emission of listener and speaker responses of verbal behavior between the mother and child (i.e., both mother and child could respond as either the listener or speaker. The definitions of the observed verbal behaviors were categorized by verbal operants and additional verbal behaviors. Verbal operants included tacts, mands, echoics, intraverbals, and textual responses. Refer to Table 1 for the seminal definitions of Skinner’s (1957) verbal operants and a comparative description from a linguistic analysis of language.

Additional verbal behaviors included written behavior, fantasy play, approvals, disapprovals, and no-responses. Each of these verbal behaviors were emitted in the form of vocal verbal behavior (VB), non-lexical vocal verbal behavior (NL), or non-vocal verbal behavior (NV) all with a function to communicate. Vocal non-verbal behavior was also identified to clarify what verbal behavior is and is not. Refer to Table 7 for a description and examples of the different types of verbal behavior emitted by the participants. Refer to Table 8 for a list of abbreviations used within the study.

Table 7

Types of Verbal Behavior

Type	Description	Examples
Vocal Verbal Behavior	Vocal verbal behaviors consist of listener and speaker responses emitted across verbal operants. The communicative responses function as either initiated or response verbal behavior between two or more persons in the same verbal community or by one's self aloud (i.e., self-talk). Vocal verbal responses are emitted in an *audible* form with lexical vocalizations (i.e., containing words, phrases, or sentences).	- Tact - Mand - Echoic - Intraverbal - Textual response - Fantasy play - Approval - Disapproval *Ex. Boy vocally mands to mother "I want juice."*
Vocal Non-Lexical Verbal Behavior	Non-lexical vocal verbal behaviors consist of communicative listener and 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.	- Tact - Mand - Intraverbal - Fantasy play - Approval - Disapproval *Ex. Laugh, hmmm, grunts, an attempted word, a cry, whine, or whimper.*
Non-Vocal Verbal Behavior	Non-vocal verbal behaviors consist of communicative listener and 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. Observing responses, gestures, and actions are used as non-vocal functions to communicate, but *no audible* response is emitted.	- Tact - Mand - Intraverbal - Fantasy play - Approval - Disapproval *Ex. Point, smile, head nod, wave, hug,*
Vocal Non-Verbal Behavior	Vocal non-verbal behaviors are simply behaviors that occur with no apparent function to communicate with other persons in the same verbal community or between one's self. Automatically reinforcing behaviors such as stereotypy are also forms of non-verbal behavior, as they have no communicative or social function.	- Scratching, coughing, sneezing, blinking - Repetitive behaviors in the form of palilalia, echolalia, hand flapping, rocking back and forth, jumping up and down, or clicking of objects.

Note. See Appendix E for more detailed examples of each behavior.

Table 8

Abbreviations

Words	Abbreviations
Vocal Verbal Behavior	VB
Non-Lexical Vocal Verbal Behavior	NL
Non-Vocal Verbal Behavior	NV
Discriminative Stimulus	Sd
Motivating Operations	MO
Interobserver Agreement	IOA
Intra-response Time	IRT

Verbal Operants

Tacts. Tact responses were defined as a verbal (VB, NL, or NV) emission of a stimulus' name, condition, or action in the presence of said stimulus. Each tact response encompassed a mand for attention. Reinforcement of social attention by the listener must have followed each tact response. An example of a VB tact – child visually sees a toy car (Sd) and says, "That's a yellow car," followed by the mother's reinforcement, "You're right, that is a yellow car!" An example of an NL and NV tact – child visually sees a toy car (Sd), engages in joint attention with the mother, and grunts (NL) while pointing to the car (NV). The joint attention for an object in the environment results in social attention from the mother.

Tact responses also encompassed metaphorical tact extensions, in which, the tact response was under the control of only part of the critical features (i.e., seeing, hearing, tasting, touching) of the discriminative stimulus. For example, a mother visually sees her child drop the ball and says, "Oh man," followed by the child's listener response of laughing. Metaphorical tact extensions were also representative of one tacting his/her own behavior such as in the emission of say-do correspondence. Say-do correspondence was a form of self-talk in which the

speaker and listener responses rotated within one's skin. For example, the mother grabs a block and emits the speaker response, "I am going to make a tower," followed by the listener response of building a tower. Each metaphorical tact extension was recorded as one tact response.

A tact episode was defined as multiple varying tacts emitted consecutively with a pause of less than 1s in between each tact that did not allow an opportunity for the listener to respond. For example, a child sees a rainbow and says, "Red, blue, purple, green, orange, yellow, a rainbow," followed by the mother's reinforcement, "Good job! Those are the colors of the rainbow." A tact episode may have also included multiple emissions of the same tact without a pause between each word (i.e., "Baby, baby, baby"), followed by the reinforcement, "Yes, that is a pretty baby." Tact episodes were also recorded as one tact response. Attempted tacts were verbal responses to a visual Sd that were not directly reinforced by the listener. For example, the mother says, "Look, a star" and the child did not attend or vocally respond to the mother's tact.

Mands. A mand response was defined as the emission of a VB, NL, or NV verbal response followed by the listener's response of delivering specific reinforcement in the form of attention, the object, information, or completing the demand. Examples of mands were as follows: mands for *attention* – mother is attending to a task (Sd), and the child wants the parent's attention (MO) so the child says, "Hey mom, look at what I can do," followed by the mother's listener response of looking at the child (with or without a speaker response); mands for *objects* – child visually sees an iPad (Sd) that he or she wants (MO) and says, "Can I play with the iPad?," followed by the mother's listener response of giving the child the iPad; mands for *information* – child visually sees an unknown object (Sd) and wants to know the name of it (MO) and says, "What is that?," followed by the mother's reinforcement, "A light switch" mands as a demand – child is playing with cars instead of cleaning up (Sd), and mother wants child to clean up (MO)

so mother says, "Let's put all the cars in the bag," followed by the child's reinforcement of putting the cars in the bag.

Mands were also emitted in NL or NV form. For example, NL mands were observed as a grunt or cry lasting less than 5 s (i.e., for "No" or "I don't want to"), clearing of the throat unrelated to health concerns (i.e., as a mand for attention), and an attempted word in the form of a sound or approximation (i.e., /b/ for bus as a mand for a toy bus). NV mands were emitted in the form of tapping someone's body part to gain the person's attention, a hand signal that represents "stop," "no," or "wait," a wave to represent "Hi," "Keep going," or "No thank you" as a demand, running/walking/crawling away from someone as a form of escape behavior, walking/running/crawling to someone or standing near to gain other's attention, nodding head up and down as a representation of "yes" or shaking head back and forth for "no" as a demand, and glaring at someone as a mand for attention.

Attempted mands were defined as a verbal response (i.e., request) emitted by a speaker without the delivery of reinforcement from the listener. Specifically, attempted mands consisted of multiple requests with the same function (i.e., for the listener to follow the demand, deliver attention/object, or provide information to the speaker). These responses were emitted in different forms (e.g., "Get the ball," "Let's play with the ball," "Get the ball please") by one person within a verbal episode. Each request within the verbal episode was emitted with a pause of 2 s or less IRT between each emission and without a response from the listener. If the listener responded to the last request with specific reinforcement, the "request" was counted as a mand. For example, a mother says, "Sit down," "Charlie I want you to sit down," "I said sit," and the child responds to the mother following her third request, "I said sit." Within this verbal episode, there were two attempted mands and one mand. The first two verbal responses were not

considered mands, as the listener did not have an opportunity to respond or the response was delayed. (See negative reinforcement and positive punishment).

Autoclitics. For this study, autoclitic responses functioned as extensions of mand and tact responses. Both definitions of tacts and mands encompassed one-word responses *and* responses with autoclitic phrases. For example, the tact "Bug" with an autoclitic phrase would be, "There is a huge bug on the floor;" the mand "Cookie" with an autoclitic phrase would be, "I want the big chocolate chip cookie." Both responses were identified and recorded as a tact and mand respectively; therefore, data on the emission of autoclitics were not collected.

Echoics. Echoic responses were defined as a VB response emitted with point-to-point correspondence for each syllable following a vocal verbal stimulus from the initial speaker (i.e., the imitating of sounds or words). For example, a single word echoic-to-tact response – mother says, "telephone" followed by the child emitting an echoic response of repeating each of the corresponding sounds, [tel-uh-fohn]. A full sentence echoic-to-mand response – mother says, "I want the ball" followed by the child saying each word in corresponding order, "I want the ball" as an echoic-to-mand function for child to request the object using words. Echoic-to-mand and echoic-to-tact responses were recorded as echoics.

An attempted echoic or partial echoic was an echoic without point-to-point correspondence between the initial vocal verbal stimulus and the response but with formal similarity. The echoic response possessed point-to-point correspondence with one sound in the word or two words in the sentence (i.e., for full sentence echoics). For example, mother says, "telephone" and the child responds, [tel-fohn] or [fohn] at which only part or parts of the word were echoed. If the child emitted two or more of the same echoics consecutively, only one echoic was recorded. For example, if the child says, "telephone, telephone, telephone,"

following the mother's vocal antecedent, "telephone," only one echoic was recorded, as there was only one antecedent stimulus.

Intraverbals. Intraverbal responses were defined as a VB, NL, or NV verbal response to a vocal Sd; thus, a verbal exchange between a speaker and a listener. For example, the mother emits the mand, "What do you want to play with first?" followed by the child's intraverbal response, "The cars." If an intraverbal response included a tact contingent upon the presence of the nonverbal Sd, an intraverbal tact response was emitted. For example, the child points to a doll and emits the mand, "What is that?" and the mother emits the intraverbal response, "A doll" in the presence of a doll. Intraverbal tact responses were recorded as intraverbals. Intraverbal responses were also emitted in NL or NV form. For example, NL intraverbals were observed as a laugh (i.e., as a non-lexical response for "That was funny") or a "Hum?" (i.e., as a non-lexical response for "I don't know," "Maybe," or "We'll see"). NV intraverbals responses were the nodding of the head up and down as a representation of "yes" or shaking the head back and forth for "no" as an intraverbal response to "Do you want to play with the ball?"

Textual responses. Textual responses were defined as a VB response to textual print containing point-to-point correspondence with the visual text. For example, the child visually sees the word *Truck* written in a book and emits the vocal response "Truck." A textual response episode was defined as the consecutive emission of multiple textual responses with a 1 s or less pause in between each response that did not allow an opportunity for the listener to respond. For example, the child observes the letters and numbers 1, 2, 3, A, B, C painted on the wall, and emits the vocal response, "1, 2, 3, A, B, C" without pausing. A textual response episode was recorded as one textual response. Reinforcement for textual responses were social praise (e.g.,

"You're right,") an echoic response by the listener, or natural reinforcement of the speaker responding to the visual stimuli with point-to-point correspondence.

Additional Verbal Behaviors

Written behavior. Written behavior was defined as a NV verbal response using a writing utensil. Although transcription (i.e., a written or visual response to a visual Sd) is one of Skinner's verbal operants, transcription was not observed during the video sessions; however, dictation was observed (i.e., a written or visual response following a vocal antecedent). Behavior that did not have a vocal or visual Sd, was classified as written non-vocal behavior. For example, the mother writes, "mommy" on the board for the child to textual respond to the letters; therefore, data for all written behavior was recorded as NV.

Fantasy play. Fantasy play involved giving anthropomorphic behaviors to toys (e.g., racing a toy car), inanimate objects (e.g., shooting the villain with a pencil), or actions (e.g., talking on a phone by holding your thumb to your ear and pinky finger to your mouth). More extensively, fantasy play involved the emission of these anthropomorphic behaviors across conversational units between one's self (i.e., the listener and speaker are joined within one's skin and responses are rotated aloud through either self-talk or say-do correspondence (Lodhi & Greer, 1989)), or between one's self *and* another person. This study analyzed the latter. For example, a child holds toy phone to his ear and pretends to call his dad, the mother holds her pretend hand phone to her ear and responds to the child in a deep voice as if she were the dad. Each instance of listener and speaker responses was recorded as fantasy play.

Approvals. Approvals emitted by the mother were defined as VB, NL, and NV verbal behavior directed toward the child to endorse, commend, and praise the correct, or desired behaviors, or as a function of attention. These actions function to reinforce behavior of children

who demonstrate conditioned reinforcement for adult attention (Elby & Greer, 2017; Schmelzkopf et al., 2017). 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 words, such as laughs or approving sounds (e.g., "Whoa!"). Non-vocal approvals were defined as approvals delivered through facial expressions, gestures, or physical contact. For example, facial expression (e.g., smile, wink, blow kiss), a gesture (e.g., nods head, thumbs up, claps), or physical contact (e.g., high fives, fist bump, hugs, kiss).

Disapprovals. Disapprovals emitted by the mother were defined as VB and NV verbal behavior directed toward the child in attempt to reprimand or punish inappropriate behaviors. 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-vocal disapprovals were defined as reprimands delivered in the form of facial expressions, gestures, or physical contact. For example, facial expressions (e.g., rolling of eyes, frowns, or glares with squinted eyes and a furrowed brow), a gesture (e.g., finger or hand held up to represent "No" or "Stop"), or physical contact (e.g., slaps, hits, kicks, or pushing hands away).

Visual Observing responses. Observing responses were defined as NV verbal behavior in which the person directed his/her head and/or eyes toward the other person or object the person had or was reaching for. Observing responses may have functioned as mands for attention or NV responses to a speaker's verbal operant. Observing responses were recorded as NV verbal behavior.

Inaudible. Inaudible responses were defined as responses that were difficult to hear due to a faulty microphone connection. An inaudible response was written as IA on the data sheet to

indicate a response occurred within a social interaction; however, the response was not recorded as a specific verbal behavior.

Vocal Non-Verbal Behavior. Vocal non-verbal behaviors were defined as audible responses in the form of lexical words, phrases, or sentences that did not have observable stimulus relations, such as the overtly emitting the name of an object or condition that was not visible in the presence of the speaker's immediate environment or vocal stereotypy (i.e., palilalia or echolalia -- the repetition of words or phrases). These behaviors were not recorded as a verbal behavior response as the function of the behavior was unknown.

No-Response

No-responses were defined 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. If the speaker reinitiated before the end of the 3 s and the listener did *not* respond following 3 s or more, a no response was recorded. Refer to Appendix C for an example of a completed data sheet with a no-response.

Data Collection Procedure

Data were collected using event recordings across the emission of verbal responses and episodes between mother and child dyads during a 5-min free-play session. Since the free-play session took place within a 5-min block of a 25-min video recording, there was video feed before and after the free-play session that did not pertain to this study. Each session was in time blocks that began when the experimenter closed the door and the session ended exactly 5-min later (e.g., if the session began at 13:24, it ended at 18:24). Doing so ensured data were collected for each dyad across the exact same duration. If a participant emitted a response before the door was closed or a response extended past the 5-min session, data for that emitted behavior were not

recorded.

A verbal response was the emission of a listener or speaker response in the form of VB, NL, and/or NV verbal operant or additional verbal behaviors emitted by the mother or child. Each verbal response had a corresponding letter code. Refer to Table 9 for a list of the behavior codes used. The data sheet consisted of rows of boxes that alternated between mother (M) and child (C) response opportunities. Each box contained all the verbal behavior codes one may have emitted within a listener or speaker response. The experimenter recorded the responses by circling *all* the verbal behaviors emitted before the next person responded; therefore, each box may have had multiple behaviors circled. The order of the boxes used to record the data was imperative as each person's response(s) represented the alternation of the listener and speaker roles. Refer to Appendix B for an example a completed data sheet. In instances in which a verbal operant was emitted in NL or NV form, both the code for the verbal operant was circled and NL or NV respectively. If a verbal response was emitted in NL or NV form, and was unclear to the observer if the response was a verbal operant, only NL and/or NV was circled. Any questionable responses were starred and later reviewed with a second observer.

Table 9

Behavior Codes for Data Collection Procedure

Behavior	Code	Behavior	Code	Behavior	Code
Tact	T	Echoic	E	Approval (Mother)	A
Attempted Tact	Ta	Intraverbal	IV	Disapproval (Mother)	D
Mand	M	Textual Responses	TR	Non-Vocal Verbal Behavior	NV
Attempted Mand	Ma	Fantasy Play	FP	Non-Lexical Vocal VB	NL

An interval was defined by the exchanges of verbal responses between the mother and the child until a no-response occurred (i.e., 3 s IRT). There was no predetermined amount of time an interval was to last, as it could have lasted from 1 s up to 5-min. Multiple intervals may have occurred within the free-play session contingent on the number of no-responses. The intervals may have contained multiple rows of verbal responses. Using the time stamp located on the video screen when it was in pause mode, the beginning and ending time for each row was recorded to allow for an observer to return to the response in question for calibration and IOA purposes. A no response was indicated by a large "x" through the box of the person who did not respond and indicated the end of the interval. When the next interval began as indicated by the next response, it was recorded in the corresponding box (i.e., mother or child) on the next row. The 3 s IRT was included in the interval time recording.

Interobserver Agreement

Interobserver agreement (IOA) was collected for 31% of the videos, in which a second observer selected participants at random and independently watched the videos while transducing the behaviors accordingly. Prior to the second observer collecting IOA on the

participants, three preliminary videos were used to calibrate data collection procedures. Additionally, examples of each behavior were used for IOA purposes to assist in the clarification of measuring target responses. Refer to Appendix E for examples of target responses across each emission of verbal behavior. Once the second observer finished collecting data, the first experimenter calculated point-to-point agreement for each corresponding behavior by dividing the number of behaviors in agreement by the number of behaviors agreed upon, plus the number of behaviors disagreed upon, and multiplied the quotient by 100.

Given the nature of the data collection procedure in which behaviors were transduced by the millisecond, the observers reconvened following the collection of IOA to ensure "disagreements" were in fact disagreements and not missed opportunities by an observer. This retrospective observation was necessary to insure the reliability of the behaviors collected and accurately reflect the IOA between the observers. The IOA reported in the study represented the recalculated IOA after the observers convened. The target IOA was set at 70% to accommodate for the rigorous data collection procedure. Refer to Table 10 for the mean percentage of the final point-to-point agreements reported across 11 dyads as well as an example of the differences between the initial IOA collected and the final IOA reported for one dyad.

Table 10

Point-to-Point Interobserver Agreement Collected across Mother and Child Verbal Behaviors

Behaviors	Mean % of Agreement	Range of Agreement	Example of Initial – Final Agreement
Conversational Units	90%	82% - 97%	70% - 82%
Non-Vocal Verbal Behavior	84%	77% - 93%	65% - 79%
Attempted Mands	85%	71% - 100%	51% - 75%
No-Responses	98%	88% - 100%	100% - 100%
Child Vocal Verbal Behavior	95%	85% - 100%	82% - 100%
Child Non-Lexical Verbal Behavior	90%	80% - 100%	68% - 89%
Child Fantasy Play	97%	81% - 100%	100% - 100%
Mother Approvals	96%	83% - 100%	100% - 100%
Mother Disapprovals	98%	88% - 100%	50% - 100%

Dependent Variables

Upon conclusion of collecting data on each instance of verbal behavior emitted between the mother and child, the researcher transduced the behaviors across 10 continuous dependent variables. The continuous variables collected for both mother and child consisted of initiated conversational units, NV verbal behavior, attempted mands, and no-responses; child only continuous variables were vocal verbal behavior, NL verbal behavior, and fantasy play; and mother only continuous variables were approvals and disapprovals. Two experimenters calculated the totals for each variable twice across all participants to ensure relatability. Previously collected educational variables for the child were analyzed and consisted of the ADOS-2 severity score, ADOS-2 module used to assess for ASD severity, and the number of C-

PIRK communication objectives. The independent variable consisted of the child's level of verbal behavior in accordance with their performance on the VBDA-R. To control for observer drift and ensure the integrity of the data collected, the observers were blind to the educational and independent variables while collecting data for each continuous variable across the dyads.

Mother-Child Continuous Variables

Conversational units, non-vocal verbal behavior, no-responses, and attempted mands (mother and child). Conversational units were collected across child-initiated and mother-initiated. A conversational unit was a bidirectional operant defined by the verbal exchanges between the mother and the child. The initial speaker response was followed by a listener response, and then a second speaker response [*mother* — child — *mother*]. For example, (mother) "What do you want to play with first?" (child) "The cars," (mother) "Okay, let's play with this car;" thus, one conversational unit was recorded for the mother. If the child responded a second time [mother — *child* — mother — *child*], a conversational unit was recorded for the child.

Conversational units included any instance of VB, NL, or NV verbal behavior that were exchanged between the mother and child (i.e., did not always include words or phrases). For example, (mother) "Let's play catch," (child) picks up ball and tosses it at the mother, (mother) "Good throw," catches the ball, and throws it back to the child, (child) smiles and catches the ball. The researcher collected data for conversational units based on exchanges of verbal responses between the mother and the child as denoted by three boxes side by side on the data sheet. Data were also collected across NV verbal behavior, no-responses, and attempted mands emitted by the mother and child (see *Target Behaviors and Measures* for definitions of each). Cumulative data for each verbal behavior were tallied separately for the child and mother

respectively. Refer to Appendix D for an example of a completed data sheet with identified mother- and child-initiated conversational units.

Vocal verbal behavior, non-lexical verbal behavior, and fantasy play (child only). Vocal verbal behavior was collected across the child's cumulative emission of vocal verbal tacts, mands, intraverbals, and echoic responses. Using the provided transcriptions for each video dialogue, the counts of vocal verbal behavior were confirmed, as the vocal VB had to consist of intelligible words, phrases, or sentences. Data were also collected across the emission of NL verbal behavior and fantasy play emitted by the child (see *Target Behaviors and Measures* for definitions of each). Cumulative data for each verbal behavior were tallied separately for each child. Results of fantasy-play emitted by the child can be found in the Appendix as it was not a preliminary statistical variable and the data were only later added and analyzed. As a result of the late findings, there is not a review of literature on fantasy play reported in the study. Refer to the Appendix F for a visual display of the emission of fantasy play across the child's level of verbal behavior.

Approvals and disapprovals (mother only). Data were collected across approvals and disapprovals emitted by the mother to the child (see *Target Behaviors and Measures* for definitions of each). Cumulative data for each emission were tallied separately for each mother.

Child Educational Variables

Level of Verbal Behavior

The child's level of verbal behavior was categorized across three different levels and analyzed as a categoirical variable. The child was categorized as a (1) if functioning at the pre-foundational level of verbal behavior, a (2) if functioning at an independent listener or speaker level of verbal behavior, a (3) if functioning at the bidirectional level of verbal behavior. The

levels of verbal behavior were identified using the VBDA-R and determined by the number of behavioral cusps and cusps as learning capabilities the child had within his repertoire prior to the pre-recorded video assessment. It is important to note that the VBDA-R assesses more cusps and capabilities than the ones listed below. Refer to Table 3 for a description of the verbal behavioral cusps and cusps as learning capabilities across each level of verbal behavior.

Pre-foundational level of verbal behavior. The pre-foundational level of verbal behavior consisted of five cusps. To be considered functioning at this level of verbal behavior, the child had one or all the pre-foundational behaviors within his or her repertoire, as represented by a score between 1-5 on the VBDA-R.

Independent level of verbal behavior. The independent level of verbal behavior consisted of children functioning on either the independent listener or both the listener and independent speaker levels of verbal behavior. The group was combined only for this study to control for a small sample size of listeners. The listener level of verbal behavior was representative of four listener behaviors. To be categorized as a listener, the child had to have *both* basic listener literacy and auditory match-to-sample selection response within his or her repertoire. The child had all the foundational cusps and capability, and at least two or more listener cusps within his or her repertoire, as represented by a score of 7-9 on the VBDA-R. The speaker level of verbal behavior was representative of five speaker behaviors. To be identified as a speaker, the child had to have transformation of establishing operations within his/her repertoire and represented by a score of 10-14 on the VBDA-R. As a result of joining the groups, the independent level of verbal behavior was represented by a score between 7-14 on the VBDA-R.

Bidirectional level of verbal behavior. The bidirectional level of verbal behavior

represented the independent listener and speaker cusps and capabilities joining as one and consisted of the following: the speaker component of naming, bidirectional naming (BiN - listener and speaker), say-do correspondence, and self- talk. Of the four cusps and capabilities, the child had to have full naming within his or her repertoire. The child had most all the foundational, independent listener and speaker cusps and capabilities, as well as two or more bidirectional cusps and capabilities within his or her repertoire, as represented by a score between 16-18 on the VBDA-R.

Child Educational Variables

ADOS-2 Severity Score and Modules

To verify all participating children's diagnosis and to document the level of ASD severity, 33 participating children were administered the ADOS-2 (Lord et al., 2012) by research reliable PhD students in the school psychology and ID/Autism programs at Teachers College. Research level reliability was attained prior to administering ADOS-2. The examiners achieved on-site reliability with a research reliable individual with a PhD in Applied Behavior Analysis, who had been trained by ADOS-2 trainers and obtained 80% reliability with these trainers. Reliability was defined as greater than or equal to 80% on two consecutive administrations for each module. Only the ADOS-2 Modules 1, 2, and 3 were used in this study as they targeted children (i.e., Module 4 targets teens and adults) and were analyzed as a categorical variable. The ADOS-2 severity score was also analyzed as a categorical variable and used to determine the participants range of autism severity across a spectrum: no evidence (1-2), low (3-4), moderate (5-7), or high (8-10). If the child scored a 2 or below on the ADOS-2 regardless of the module used, they were not accepted into the study.

Of the children administered the ADOS-2, all but one met criteria for ASD at the following levels of severity: low (n = 3, 8.6%), moderate (n = 13, 37.1%), high (n = 17, 48.6%). Each ADOS-2 module was used across the following number of participants: Module 1 (n = 18, 51.4%), Module 2 (n = 10, 28.6%), Module 3 (n=5, 14.3%). Two participants had moved away after participating in the first portion of the study and were not administered the ADOS-2. Instead, an administrator, with a PhD in Applied Behavior Analysis, at the school familiar with the children, completed the *Childhood Autism Rating Scales–Second Edition* (CARS-2) with input from the child's classroom teacher.

C-PIRK Repertoires

Cumulative C-PIRK objectives represented a criterion-referenced assessment tool for each child and were analyzed as a continuous variable. The C-PIRK assessed academic literacy, communication, community of reinforcers, self-management skills, and physical development. Refer to Table 4 for a detailed sequence of the objectives across each domain. Long-term objectives (LTO) in each section encompassed one or more short-term objective (STO). In this study, only the objectives in the communication and social repertoires domains acquired by each child were targeted. The number of previously acquired objectives were calculated across the listener, speaker, social intraverbal, and social repertoires domains as these skills coincided with the verbal behaviors measured in the videos.

Vineland-3 Overall Scores

The Vineland-3 assesses skills across five domains with a total of 13 subdomains. For the purpose of this study, only the scores across the communication domain were analyzed. This domain targeted the assessment of receptive (i.e., listening), expressive (i.e., speaking), and written behaviors used to communicate. The child's overall total score of the communication

section was analyzed as a continuous variable.

Mother Demographic Variables

The demographic categorical variables for the mother were her level of educational background and household income collected within a questionnaire. The level of education background was divided into four groups: (1) GED, (2) No Bachelor's degree (i.e., some college or associates degree), (3) Bachelor's degree, and (4) Graduate degree (i.e., master's, professional degree, and doctoral degree). The mother's household income was also categorized into four groups: (1) *low* income with less than $10,000 -$49,999, (2) *low to moderate* income between $50,000 - $74,999, (3) *moderate to high* income between $75,000 - $99,999, and (4) *high* income level falling between $100,000 - $200,000. Results of mother's demographic variables are in the Appendix. Refer to the Appendix G for a visual display of the effect mother's educational levels has on her emission of no-responses. Refer to Appendix H for a visual display of the effect mother's educational levels has on her delivery of approvals.

Statistical Approach

To analyze bivariate associations and differences between variables of interest a series of statistical tests were conducted. One-way Analysis of Variance (ANOVA) tests were used to find the differences between categorical and continuous variables. To find the correlation between the categorical and continuous variables, Spearman's rank-order correlations were conducted. When two continuous variables were analyzed, Pearson's product-moment correlation coefficients were used. Statistical significances were reported at the $\alpha < 0.01$ and $\alpha < 0.05$ levels. All analyses were conducted in SPSS 24.0. Refer to Table 14 for a snapshot of all results across each variable, the analysis used, and significance for each research question.

Chapter III

RESULTS

Child Level of Verbal Behavior and Educational Assessments

The first research question tested for the differences and relationships between a child with autism's level of verbal behavior and C-PIRK performance, ADOS-2 severity, the ADOS-2 modules used to assess ASD severity, and overall Vineland-3 communication domain scores. A one-way Analysis of Variance (ANOVA) was conducted to examine the differences between the child's level of verbal behavior and the number of C-PIRK repertoires acquired. Results demonstrated the number of C-PIRK repertoires differed significantly across the child's level of verbal behavior, $F(2,29) = 12.602$, $p = < .001$. Post-hoc tests indicated the significant difference fell between the bidirectional and pre-foundational levels, $SE = 5.128$, $p = < .001$ and bidirectional and independent levels of verbal behavior, $SE = 5.297$, $p = .020$. Figure 3 provides a visual display of the child's mean number of C-PIRK repertoires, as related to the child's level of verbal behavior.

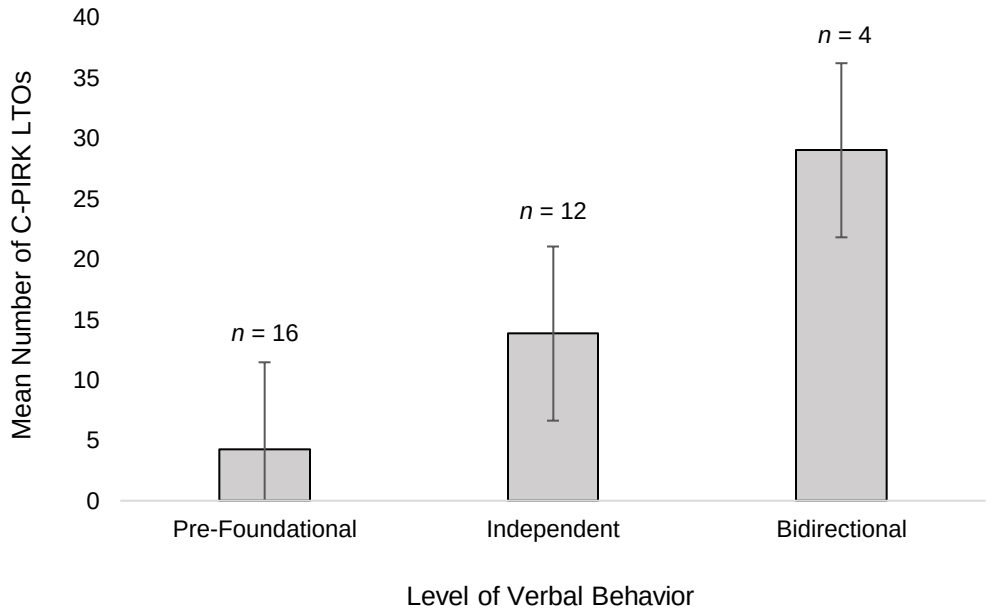

Figure 3. Mean number of C-PIRK communication objectives within the child's repertoire across each level of verbal behavior.

A one-way Analysis of Variance (ANOVA) was conducted to examine the differences between the child's level of verbal behavior and the performance on the Vineland-3 communication domain. Results revealed the Vineland-3 scores differed significantly across the child's level of verbal behavior, $F(2,31) = 21.468$, $p = < .001$. Post-hoc tests indicated the significant difference fell between the bidirectional and pre-foundational levels, $SE = 10.594$, $p = < .001$ and bidirectional and independent levels of verbal behavior, $SE = 11.303$, $p = .013$. Figure 4 provides a visual display of the child's mean number of Vineland-3 communication domain scores, as related to the child's level of verbal behavior.

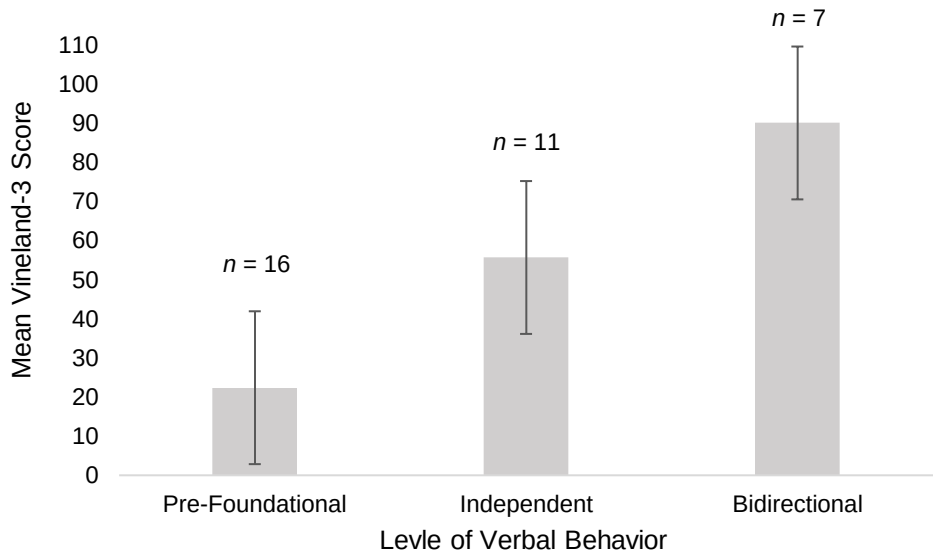

Figure 4. Mean score on Vineland-3 communication domain across each level of verbal behavior.

Spearman's nonparametric rank-order analyses were conducted to test the relationship between the child's level of verbal behavior and performance on the C-PIRK, ADOS-2 severity, ADOS-2 modules used to assess ASD severity, and the Vineland-3. C-PIRK: results showed a moderately significant correlation with the child's level of verbal behavior $r(32) = .674$, $p = < .001$, suggesting the higher the level of verbal behavior, the more C-PIRK repertoires one acquired. ADOS-2 Severity: results did not show significant correlation with the child's level of verbal behavior $r(33) = .435$, $p = -.141$, suggesting ASD severity did not vary by the levels of verbal behavior; and therefore, may not affect a child's acquisition of social/verbal repertoires. ADOS-2 Module: results demonstrated a moderately significant correlation with the child's level of verbal behavior $r(33) = .636$, $p = < .001$, demonstrating that children functioning at the pre-foundational level requires ADOS-2 Module 1, the independent level requires ADOS-2 Module 2, and the bidirectional level of verbal behavior requires ADOS-2 Module 3 when assessing for ASD severity. Vineland-3: results demonstrated a strong significant correlation with the child's level of verbal behavior $r(34) = .779$, $p = < .001$, indicating the higher the level of verbal

behavior, the higher score on the Vineland-3 communication domain. Table 11 provides the correlation coefficients between child's level of verbal behavior and assessments.

Table 11

Correlations Between Child's Level of Verbal Behavior and Assessments

Variables	1	2	3	4	5
1. Level of Verbal Behavior	–				
2. C-PIRK Repertoires	.674**	–			
3. ADOS-2 Severity	-.141	-.061	–		
4. ADOS-2 Module	.636**	.459*	-.208	–	
5. Vineland-3 Scores	.779**	.599**	.406	.835**	–

Note. Significance levels: $^{*}p < .05$ $^{**}p < .01$. Pearson correlations were conducted across variables 2 and 5. Spearman correlations were conducted across with variables 1, 3, and 4.

Child Interactions with Mother Across Level of VB and Assessments

The second research question examined the differences and relationships between a child with autism's level of verbal behavior and the frequency of verbal behavior emitted with the mother (i.e., child initiated conversational units, vocal, non-lexical, and non-vocal verbal behaviors, attempted mands, and no-responses emitted toward the mother).

Child-Initiated Conversational Units

A one-way Analysis of Variance (ANOVA) was conducted to test for differences between the child's level of verbal behavior and the mean number of conversational units initiated by the child. The results showed there was no significant difference between the child's level of verbal behavior and the number of conversational units initiated by the child, $F(2,32) =$

.431, $p = .653$. Figure 5 shows a visual display of the mean number child-initiated conversational units emitted across each level of verbal behavior.

Parametric and nonparametric analyses were conducted to test for associations between the emission of child-initiated conversational units and the child's level of verbal behavior and educational assessments. The results indicated there was no association with the child's level of verbal behavior (nonparametric), $r(35) = -.139$, $p = .426$. These results were mirrored across the child's performance on the C-PIRK (parametric), $r(32) = -.079$, $p = .669$; ADOS-2 severity score (nonparametric), $r(33) = .175$, $p = .331$; ADOS-2 Module (nonparametric), $r(33) = -.247$, $p = .167$; and Vineland-3 (parametric), $r(34) = -.222$, $p = .207$. The findings suggested children with ASD initiated the same number of conversational units with his/her mothers regardless of the child's level of verbal behavior, number of C-PIRK repertoires, ASD severity, and performance on the Vineland-3 communication domain. Table 12 provides the correlation coefficients between the child's interactions with the mother and child's level of verbal behavior and assessment performance.

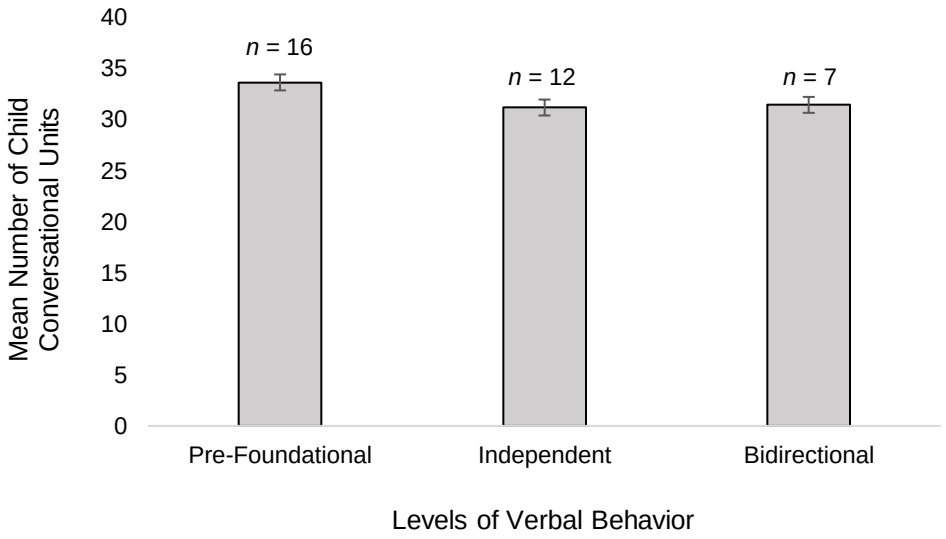

Figure 5. Mean number of child-initiated conversational units emitted across each level of verbal behavior. *Note.* Conversational units emitted by the pre-foundational level consisted of short social interactions with few to no words.

Child Vocal Verbal Behavior

A one-way Analysis of Variance (ANOVA) was conducted to test the differences between the child's level of verbal behavior and the mean number of vocal verbal behaviors emitted by the child. The results demonstrated significant differences between the child's level of verbal behavior and the child's emission of vocal verbal behavior, $F(2,32) = 16.886$, $p = < .001$. Post-hoc tests specified the significant differences were between the bidirectional and pre-foundational levels, $SE = 75.766$, $p = < .001$ and the bidirectional and the independent levels of verbal behavior, $SE = 6.051$, $p = .034$. Figure 6 provides a visual display of the child's mean number of vocal verbal behaviors emitted, as related to the child's level of verbal behavior.

Parametric and nonparametric analyses were conducted to test for associations between the emission of vocal verbal behavior and the child's level of verbal behavior and educational assessments. A strong significant relationship was demonstrated with the child's level of verbal behavior (nonparametric), $r(35) = .736$, $p = < .001$. The results reflected the ADOS-2 Module

used (nonparametric), $r(33) = .729$, $p = < .001$ and Vineland-3 scores (parametric), $r(34) = .798$, $p = < .001$. A moderately significant association was shown with the child's performance on the C-PIRK (parametric), $r(32) = .686$, $p = < .001$. The results did not show a significant relationship with the ADOS-2 severity score (nonparametric), $r(33) = -.225$, $p = .208$. The results demonstrated that children who function at higher levels of verbal behavior, acquire more C-PIRK repertoires, score higher on the Vineland-3 communication domain, and require a higher ADOS-2 Module to assess for ASD severity emit more vocal verbal behaviors with his/her mothers. The results also demonstrated that ASD severity is not an indication of a child's emission of vocal verbal behavior. Table 12 provides the correlation coefficients between the child's interactions with the mother and child's level of verbal behavior and assessment performance

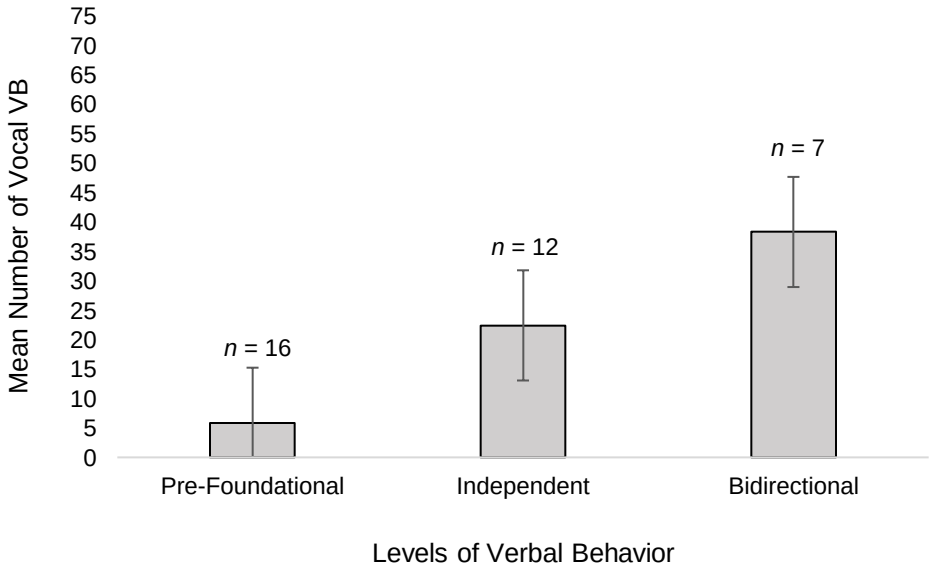

Figure 6. Mean number of vocal verbal behaviors emitted by the child across each level of verbal behavior.

Child Non-Lexical Vocal Verbal Behaviors

A one-way Analysis of Variance (ANOVA) was used to analyze the differences between the child's level of verbal behavior and the mean number of non-lexical vocal verbal behaviors

emitted by the child. The results showed a significant difference between the child's level of verbal behavior and the child's emission of non-lexical vocal verbal behavior, $F(2,32) = 7.560$, $p = .002$. Post-hoc tests indicated the significant differences were between the pre-foundational and independent levels, $SE = 4.262$, $p = .034$ and the pre-foundational and bidirectional levels of verbal behavior, $SE = 5.058$, $p = .006$. Figure 7 provides a visual display of the child's mean number of non-lexical vocal verbal behaviors emitted across the levels of verbal behavior.

Parametric and nonparametric analyses were conducted to test for relationships between the emission of non-lexical vocal verbal behavior and the child's level of verbal behavior and educational assessments. A moderately significant correlation was shown with the child's level of verbal behavior (nonparametric), $r(35) = -.648$, $p = < .001$. The results were emulated with a moderate-to-low significant association with the C-PIRK (parametric), $r(32) = -.375$, $p = .035$; the ADOS-2 Module (nonparametric), $r(33) = -.424$, $p = .014$; and Vineland-3 scores (parametric), $r(34) = -.433$, $p = .011$. The results did not demonstrate a significant association with the ADOS-2 severity scores (nonparametric), $r(33) = .028$, $p = .875$. The results indicated that children who function at lower a level of verbal behavior, acquire fewer C-PIRK repertoires, score lower on the Vineland, and require a lower ADOS-2 Module to assess for ASD severity, emit more non-lexical vocal verbal behaviors with his/her mothers. The results also demonstrated that ASD severity is not an indication of a child's emission of non-lexical verbal behavior. Table 12 provides the correlation coefficients between the child's interactions with the mother and child's level of verbal behavior and assessment performance.

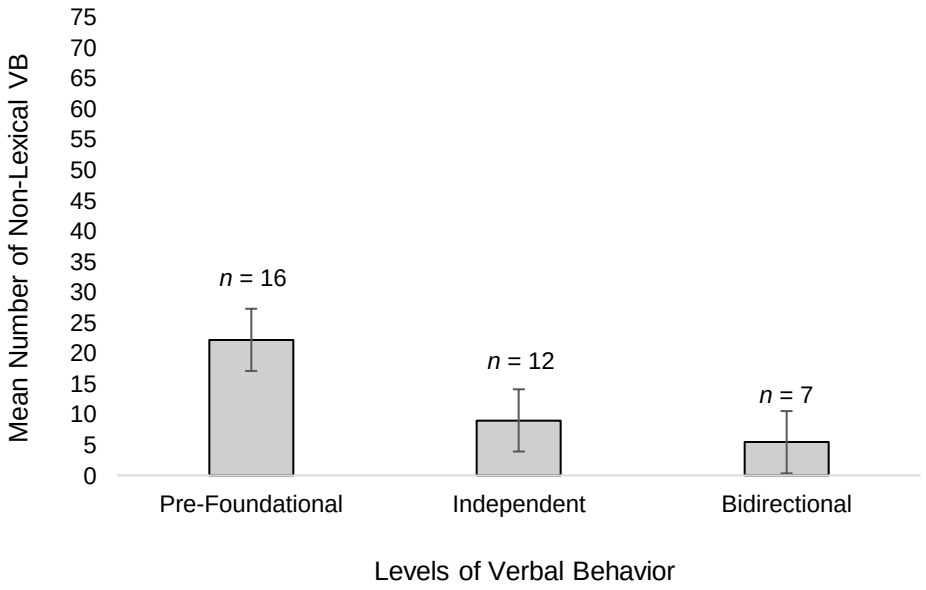

Figure 7. Mean number of non-lexical vocal verbal behaviors emitted by the child across each level of verbal behavior.

Child's Non-Vocal Verbal Behavior

A one-way Analysis of Variance (ANOVA) was conducted to examine the differences between the child's level of verbal behavior and the mean number of non-vocal verbal behaviors emitted by the child. The results demonstrated a significant difference between the child's level of verbal behavior and the child's emission of non-vocal verbal behavior, $F(2,32) = 3.661$, $p = .037$. Post-hoc tests indicated a marginally significant difference between the pre-foundational and bidirectional levels of verbal behavior, $SE = 7.937$, $p = .067$. Figure 8 provides a visual display of the child's mean number of non-vocal verbal behaviors, as related to the child's level of verbal behavior.

Parametric and nonparametric analyses were conducted to test for relationships between the emission of non-vocal verbal behavior and the child's level of verbal behavior and educational assessments. A moderate-to-low significant correlation was shown with the child's level of verbal behavior (nonparametric), $r(35) = -.433$, $p = .009$. The results were emulated with

the child's performance on the C-PIRK (parametric), $r(32) = -.358$, $p = .044$; a moderate significant relationship with the ADOS-2 Module (nonparametric), $r(33) = -.519$, $p = .002$; and Vineland-3 scores (parametric), $r(34) = -.518$, $p = .002$. The results did not demonstrate a significant association with the ADOS-2 severity scores and non-vocal verbal behavior (nonparametric), $r(33) = .154$, $p = .392$.

The results indicated that children who function at lower a level of verbal behavior, acquire fewer C-PIRK repertoires, score lower on the Vineland, and require a lower ADOS-2 Module to assess for ASD severity, emit more non-vocal verbal behaviors with his/her mothers. The results also demonstrated that ASD severity is not an indication of a child's emission of non-vocal verbal behavior. Table 12 provides the correlation coefficients between the child's interactions with the mother and child's level of verbal behavior and assessment performance.

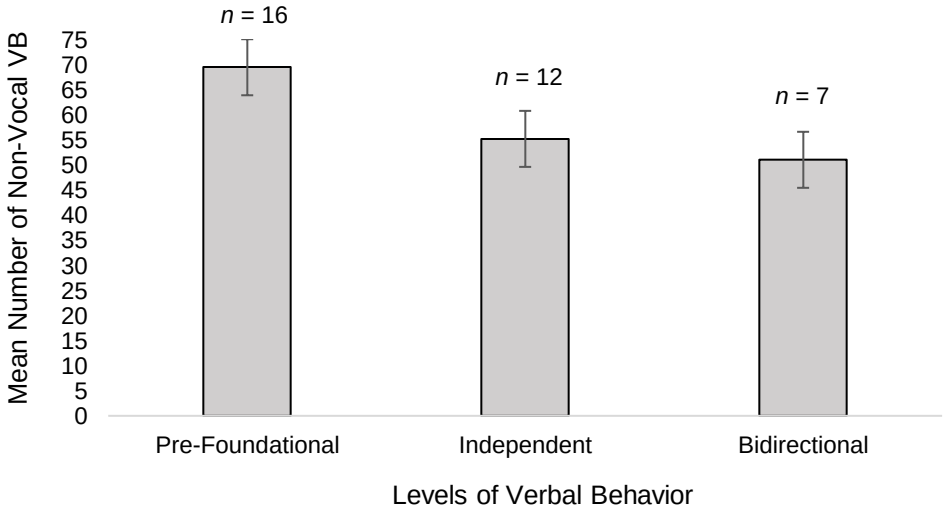

Figure 8. Mean number of non-vocal verbal behaviors emitted by the child across each level of verbal behavior.

Child Attempted Mands

A one-way Analysis of Variance (ANOVA) was used to test for differences between the child's level of verbal behavior and the number of attempted mands emitted by the child. The

results indicated there was a significant difference between the child's level of verbal behavior and the child's emission of attempted mands, $F(2,32) = 4.198$, $p = .024$. Post-hoc tests suggests the significant difference was between the pre-foundational and independent levels of verbal behavior, $SE = 1.933$, $p = .019$ across a curvilinear relationship. Figure 9 provides a visual display of the child's mean number of attempted mands, as related to the child's level of verbal behavior.

Parametric and nonparametric analyses were used to analyze correlations between the emission of attempted mands by the child and level of verbal behavior and educational assessments. The results indicated no relationship with the child's level of verbal behavior (nonparametric), $r(35) = -.126$, $p = .471$. These results were paralleled across the child's performance on the C-PIRK (parametric), $r(32) = -.085$, $p = .644$; ADOS-2 severity score (nonparametric), $r(33) = .066$, $p = .716$; ADOS-2 Module (nonparametric), $r(33) = -.165$, $p = .359$; and Vineland-3 (parametric), $r(34) = -.211$, $p = .231$. The results indicate children functioning at the pre-foundational and bidirectional levels emitted more mands that were not reinforced (i.e., attempted mands) as often as the independent level of verbal behavior. Table 12 provides the correlation coefficients between the child's interactions with the mother and child's level of verbal behavior and assessment performance.

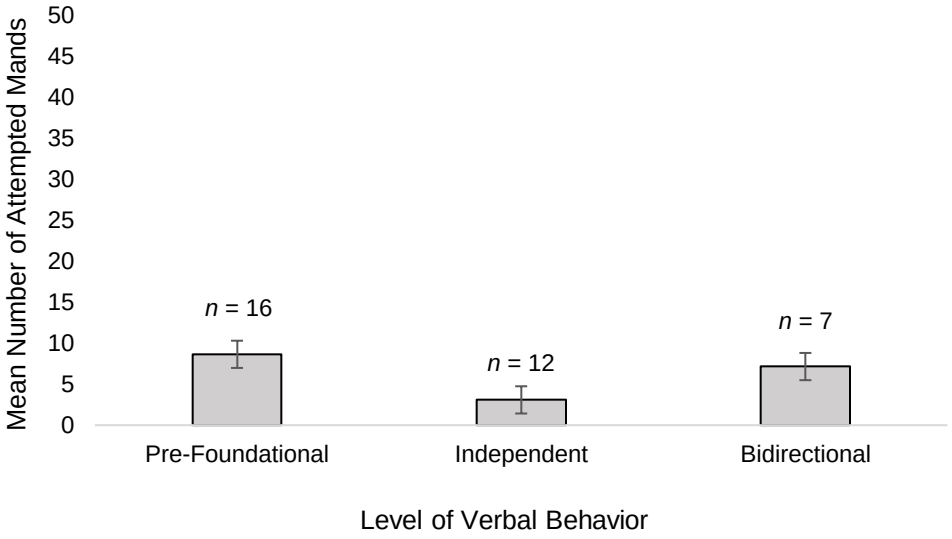

Figure 9. Mean number of attempted mands emitted by the child across each level of verbal behavior.

Child No-Responses

A one-way Analysis of Variance (ANOVA) was conducted to assess the differences between the child's level of verbal behavior and the number of no-responses emitted by the child. The results showed no significant difference between the child's level of verbal behavior and the number of no-responses the child emitted, $F(2,32) = 1.319$, $p = .282$. Although the data did not show a significant linear relationship between the groups, a curvilinear relationship between the variables was demonstrated. Figure 10 provides a visual display of the child's mean number of no-responses, as related to the child's level of verbal behavior.

Parametric and nonparametric analyses were conducted to test for associations between the emission of no-responses by the child and the level of verbal behavior and educational assessments. The results showed no association with the child's level of verbal behavior (nonparametric), $r(35) = .116$, $p = .508$. These results were mirrored across the child's performance on the C-PIRK (parametric), $r(32) = -.037$, $p = .839$; ADOS-2 severity score (nonparametric), $r(33) = -.018$, $p = .919$; ADOS-2 Module (nonparametric), $r(33) = .194$, $p =$

.278; and Vineland-3 (parametric), $r(34) = .120$, $p = .498$. The findings suggested children with ASD emitted few instances of no-responses to his/her mothers regardless of the child's level of verbal behavior, number of C-PIRK repertoires, ADOS-2 severity, and performance on the Vineland. Table 12 provides the correlation coefficients between the child's interactions with the mother and child's level of verbal behavior and assessment performance.

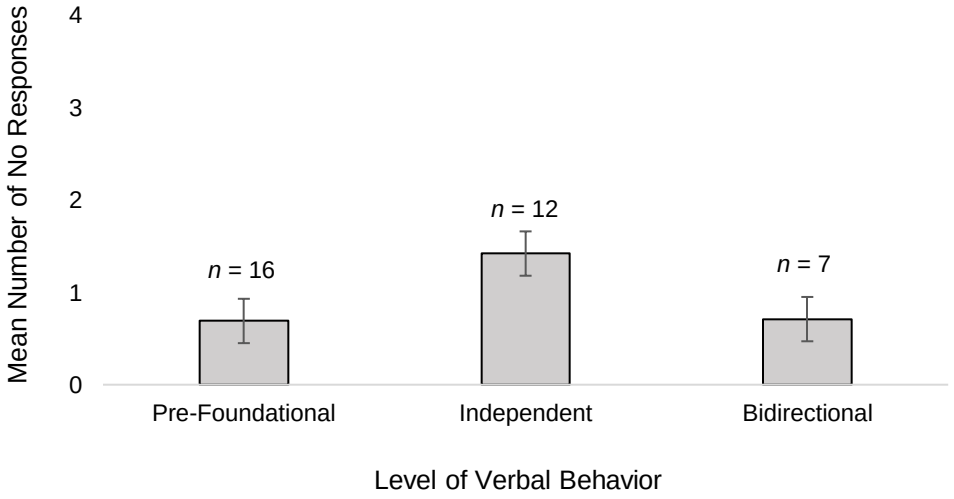

Figure 10. Mean number of no-responses emitted by the child across each level of verbal behavior.

Table 12

Correlations Between Child Interactions with the Mother and the Child's Level of Verbal Behavior and Performance on Assessment

Variables (Child)	Child's Level of VB	C-PIRK Repertoires	ADOS-2 Severity	ADOS-2 Module	Vineland-3 Scores
Child-Initiated Conversational Units	-.139	-.079	.175	.167	-.222
Vocal VB	.736**	.686**	-.225	.729**	.798**
Non-Lexical VB	-.515**	-.375*	.028	-.424**	-.433*
Non-Vocal VB	-.433**	-.358*	.154	-.519**	-.518**
Attempted Mands	-.126	-.085	.066	-.165	.120
No-Responses	.116	-.037	-.018	.194	-.162

Note. Significance levels: $^{*}p < .05$, $^{**}p < .01$. Spearman correlations were conducted for Child's VB, ADOS-2 Severity, and ADOS-2 Module. Pearson correlations were conducted for the C-PIRK and Vineland-3.

Child Level of Verbal Behavior and Mother Interactions with Child

The third research question analyzed the differences and relationships between a child with autism's level of verbal behavior and the frequency of verbal behavior emitted by the mother: mother-initiated conversational units, mothers' non-vocal verbal behaviors, no-responses, attempted mands, approvals, and disapprovals delivered to the child.

Mother-Initiated Conversational Units

A one-way Analysis of Variance (ANOVA) was conducted to test the differences between the child's level of verbal behavior and the number of conversational units initiated by the mother. The results showed there was no significant difference between the child's level of

verbal behavior and the number of conversational units initiated by the mother, $F(2,32) = .386$, $p = .683$. Figure 11 provides a visual display of the mean number of mother-initiated conversational units emitted across each level of verbal behavior. A Spearman rank-order correlation was then conducted, and the results did not show a significant correlation between the child's level of verbal behavior and the number of mother-initiated conversational units $r(35) = -.139$, $p = .425$; suggesting mother's initiated social/verbal interactions with her child regardless of the child's level of verbal behavior. Table 13 provides the correlation coefficients between child's level of verbal behavior and the mother's interactions with the child.

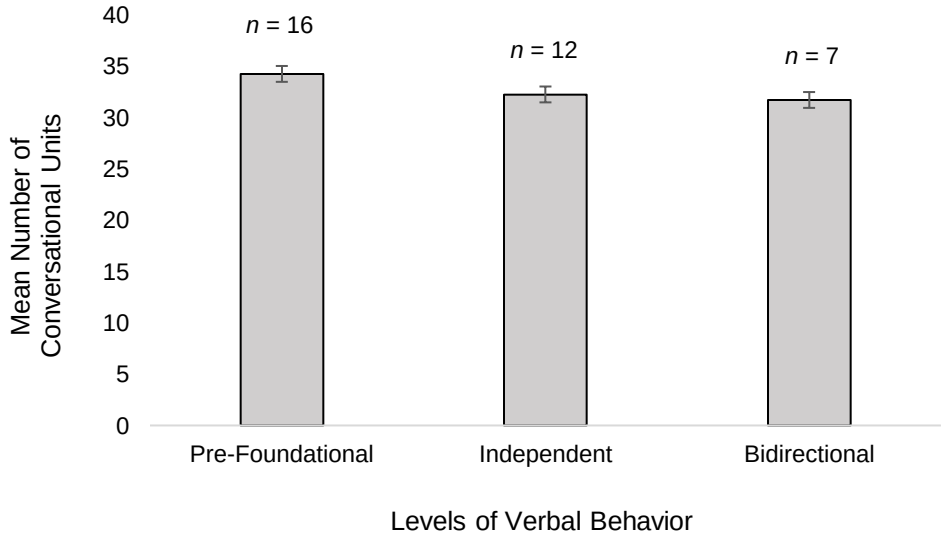

Figure 11. Mean number of mother-initiated conversational units emitted across each level of verbal behavior.

Mother Non-Vocal Verbal Behavior

A one-way Analysis of Variance (ANOVA) was used to examine the differences between the child's level of verbal behavior and the number of non-vocal verbal behaviors emitted by the mother. The results demonstrated a significant difference between the mother's emission of non-vocal verbal behavior across the child's level of verbal behavior, $F(2,32) = 4.657$, $p = .017$.

Post-hoc test indicated the significant differences fell between the pre-foundational and independent levels, *SE* = 6.934, *p* = .029 and a marginal difference between the pre-foundational and the bidirectional levels of verbal behavior, *SE* = 8.229, *p* = .068. Figure 12 provides a visual display of the mother's mean number of non-vocal verbal behaviors emitted, as related to the child's level of verbal behavior. A Spearman rank-order correlation was conducted to test the relationship between the child's level of verbal behavior and the mother's emission of non-vocal verbal behavior. The results revealed a moderate-to-low significant relationship between the child's level of verbal behavior and the mother's emission of non-vocal verbal behavior, $r(375) = -.498$, $p = .002$; suggesting mothers of children functioning at the pre-foundational level of verbal behavior emitted more non-vocal verbal behaviors with her child. Table 13 provides the correlation coefficients between child's level of verbal behavior and the mother's interactions with the child.

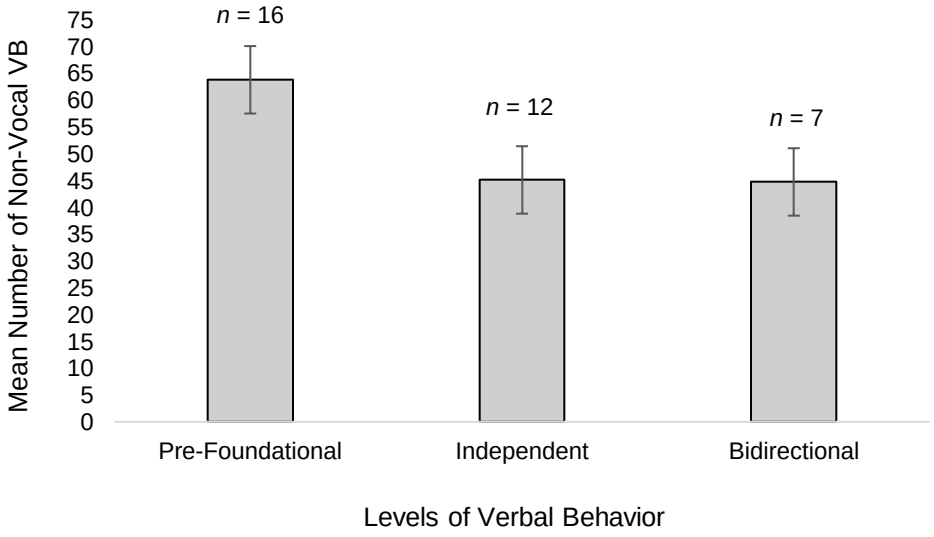

Figure 12. Mean number of non-vocal verbal behavior emitted by the mother across the child's level of verbal behavior.

Mother's Attempted Mands

A one-way Analysis of Variance (ANOVA) was used to assess the differences between the child's level of verbal behavior and the number of attempted mands emitted by the mother. According to the results, it was determined there was no significant difference between the child's level of verbal behavior and the number of attempted mands the mother emitted, $F(2,32) = .675$, $p = .516$. Figure 13 provides a visual display of the mother's mean number of attempted mands as related to the child's level of verbal behavior. A Spearman rank-order correlation was then conducted to assess for a relationship with the child's level of verbal behavior. The results did not show a significant correlation between the child's level of verbal behavior and the number of attempted mands the mother emitted, $r(35) = -.251$, $p = .145$; suggesting mands emitted by the mother were not reinforced similarly across all the levels of verbal behavior. Table 13 provides the correlation coefficients between child's level of verbal behavior and the mother's interactions with the child.

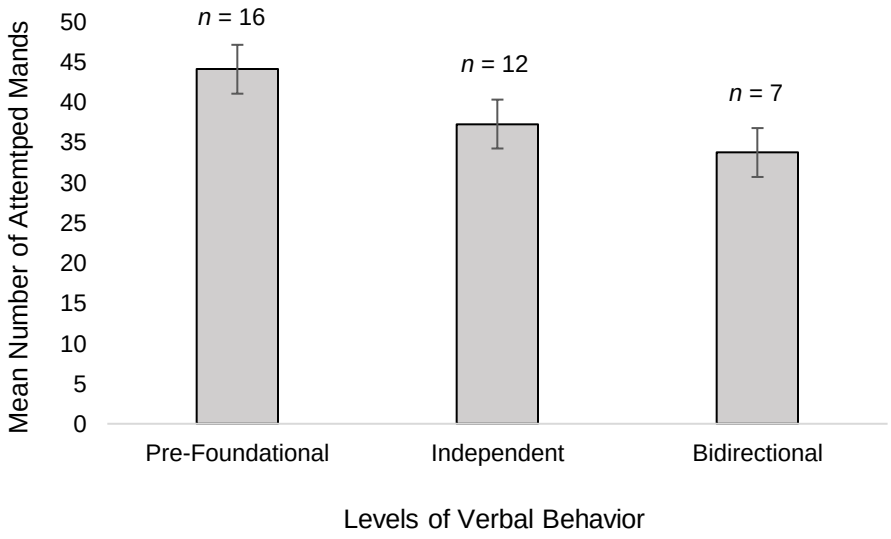

Figure 13. Mean number of attempted mands emitted by the mother across the child's level of verbal behavior.

Mother No-Responses

A one-way Analysis of Variance (ANOVA) was used to test for differences between the child's level of verbal behavior and the number of no-responses emitted by the mother. The results indicated a marginally significant difference between the child's level of verbal behavior and the mother's emission of no-responses, $F(2,32) = 2.750$, $p = .079$. Post-hoc tests were not available; however, with the levels of verbal behavior not collapsed (i.e., with 5 levels instead of 3), the data suggests mothers with children functioning at the listener level of verbal behavior emitted the most no-responses. Figure 14 provides a visual display of the mother's mean number of no-responses, as related to the child's level of verbal behavior. A nonparametric analysis was used to assess the rank-ordered relationship between the two variables, and the results did not show a significant correlation between the child's level of verbal behavior and the mother's emission of no-responses to her child, $r(35) = -.026$, $p = .882$. Although the data did not show a significant linear relationship between the groups, a curvilinear relationship between the variables was demonstrated. These findings suggest mothers emitted no responses across all levels of verbal behavior. Table 13 provides the correlation coefficients between child's level of verbal behavior and the mother's interactions with the child.

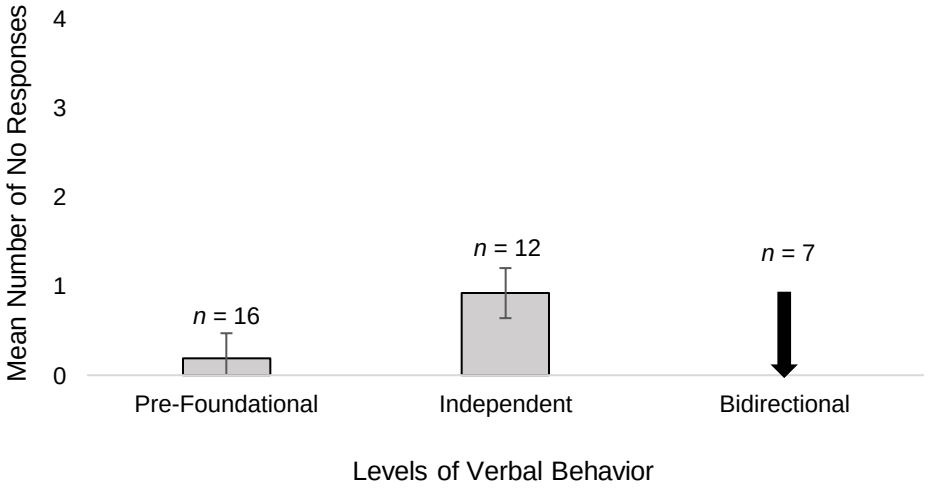

Figure 14. Mean number of no-responses emitted by the mother across the child's level of verbal behavior.

Mother's Approvals

A one-way Analysis of Variance (ANOVA) was used to assess the differences between the child's level of verbal behavior and the number of approvals delivered by the mother. According to the results, it was determined there was no significant difference between the child's level of verbal behavior and the number of approvals delivered by the mother, $F(2,32) = .980$, $p = .386$. Figure 15 provides a visual display of the mean number of approvals delivered by the mother as related to the child's level of verbal behavior. A Spearman rank-order correlation was then conducted to test for any associations. The results did not show a significant correlation between the child's level of verbal behavior and the number of approvals delivered by the mother, $r(35) = -.104$, $p = .554$; suggesting mothers delivered approvals to her child regardless of the child's level of verbal behavior. Table 13 provides the correlation coefficients between child's level of verbal behavior and the mother's interactions with the child.

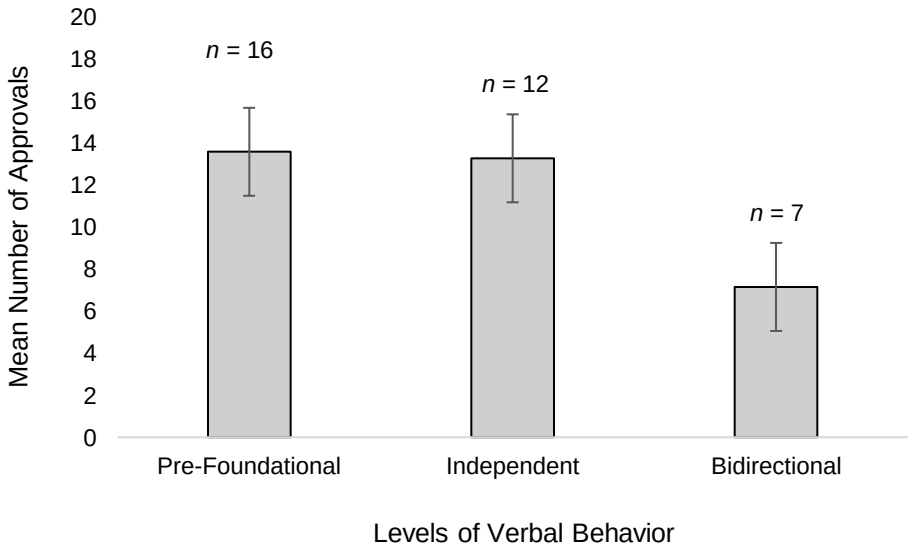

Figure 15. Mean number of approvals delivered by the mother across the child's level of verbal behavior.

Mother's Disapprovals

A one-way Analysis of Variance (ANOVA) was used to assess the differences between the child's level of verbal behavior and the number of attempted mands, approvals, and disapprovals emitted by the mother. According to the results, it was determined there was no significant difference between the child's level of verbal behavior and the number of disapprovals delivered by the mother, $F(2,32) = 1.897$, $p = .167$. Figure 16 provides a visual display of the mean number of disapprovals delivered by the mother as related to the child's level of verbal behavior. A nonparametric correlation was then conducted to test for a relationship with the child's level of verbal behavior. The results did not show a significant correlation between the child's level of verbal behavior and the number of disapprovals delivered by the mother, $r(35) = -.258$, $p = .134$. Although the data did not show a significant linear relationship between the groups, a curvilinear relationship between the variables was demonstrated. The results suggest disapprovals were delivered by the mothers regardless of her child's level of verbal behavior. Table 13 provides the correlation coefficients between child's level of verbal behavior and the mother's interactions with the child.

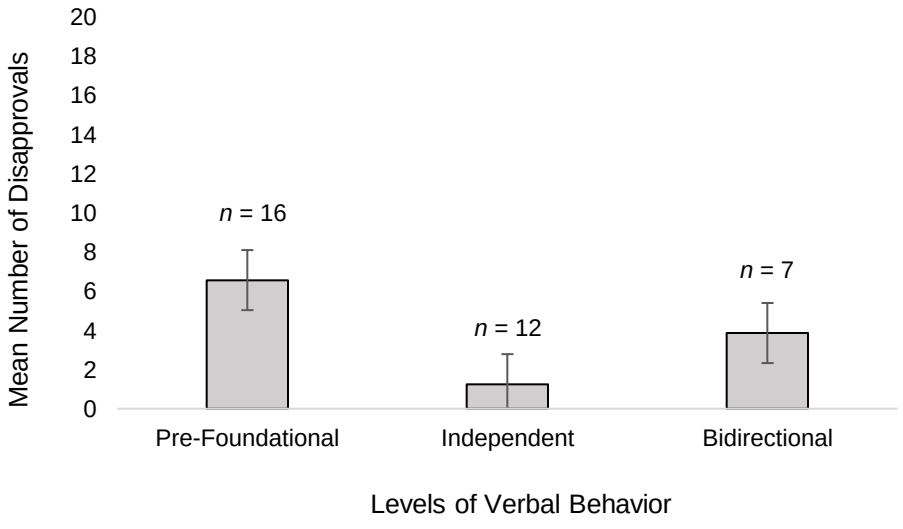

Figure 16. Mean number of disapprovals delivered by the mother across the child's level of verbal behavior.

Table 13

Correlations Between Child's Level of Verbal Behavior and Mother's Interactions with the Child

Variables (Mother)	Initiated CU	Non-Vocal VB	No Responses	Attempted Mands	Approvals	Disapprovals
Child's Level of Verbal Behavior	-.139	-.498**	-.026	-.251	-.104	-.258

Note. Significance levels: $^{*}p < .05$. $^{**}p < .01$.

Table 14

Results of Each Variable, Analysis Type, and Significance Across Research Questions

Child's Level of Verbal Behavior and Educational Assessments				
Variable 1	*Variable 2*	*Analysis*	*Results*	*Significance*
Level of VB	C-PIRK	ANOVA	$F(2,29) = 12.602$, $p = < .001$.	Significant Difference
Level of VB	Vineland-3	ANOVA	$(2,31) = 21.468$, $p = < .001$.	Significant Difference
Level of VB	C-PIRK	Spearman	$r(32) = .674$, $p = < .001$	Moderate (+) Relation
Level of VB	ADOS-2 Severity	Spearman	$r(33) = .435$, $p = -.141$	No Relation
Level of VB	ADOS-2 Module	Spearman	$r(33) = .636$, $p = < .001$	Moderate (+) Relation
Level of VB	Vineland-3	Spearman	$(34) = .779$, $p = < .001$	Strong (+) Relation
Child Interactions with Mother Across Level of VB and Assessments				
Variable 1	*Variable 2*	*Analysis*	*Results*	*Significance*
Level of VB	Child CU	ANOVA	$F(2,32) = .431$, $p = .653$	No Difference
Level of VB	Child CU	Spearman	$r(35) = -.139$, $p = .426$	No Relation
Level of VB	Child Vocal VB	ANOVA	$F(2,32) = 16.886$, $p = < .001$	Significant Difference
Level of VB	Child Vocal VB	Spearman	$r(35) = .736$, $p = < .001$	Strong (+) Relation
C-PIRK	Child Vocal VB	Pearson	$r(32) = .686$, $p = < .001$	Moderate (+) Relation
ADOS-2 Severity	Child Vocal VB	Spearman	$r(33) = -.225$, $p = .208$	No Relation
ADOS-2 Module	Child Vocal VB	Spearman	$r(33) = .729$, $p = < .001$	Strong (+) Relation
Vineland-3	Child Vocal VB	Pearson	$r(34) = .798$, $p = < .001$	Strong (+) Relation
Level of VB	Child Non-Lexical	ANOVA	$F(2,32) = 7.560$, $p = .002$	Significant Difference
Level of VB	Child Non-Lexical	Spearman	$r(35) = -.648$, $p = < .001$	Moderate (–) Relation
C-PIRK	Child Non-Lexical	Pearson	$r(32) = -.375$, $p = .035$	Mod/Low (–) Relation
ADOS-2 Severity	Child Non-Lexical	Spearman	$r(33) = .028$, $p = .875$	No Relation
ADOS-2 Module	Child Non-Lexical	Spearman	$r(33) = -.424$, $p = .014$	Mod/Low (–) Relation
Vineland-3	Child Non-Lexical	Pearson	$r(34) = -.433$, $p = .011$	Mod/Low (–) Relation
Level of VB	Child Non-vocal	ANOVA	$F(2,32) = 3.661$, $p = .037$	Significant Difference
Level of VB	Child Non-vocal	Spearman	$r(35) = -.433$, $p = .009$	Mod/Low (–) Relation
C-PIRK	Child Non-vocal	Pearson	$r(32) = -.358$, $p = .044$	Mod/Low (–) Relation
ADOS-2 Severity	Child Non-vocal	Spearman	$r(33) = .154$, $p = .392$	No Relation
ADOS-2 Module	Child Non-vocal	Spearman	$r(33) = -.519$, $p = .002$	Moderate (–) Relation
Vineland-3	Child Non-vocal	Pearson	$r(34) = -.518$, $p = .002$	Moderate (–) Relation
Level of VB	Child Att. Mands	ANOVA	$F(2,32) = 4.198$, $p = .024$	Significant Difference
Level of VB	Child Att. Mands	Spearman	$r(35) = -.126$, $p = .471$	No Relation
Level of VB	Child No Responses	ANOVA	$F(2,32) = 1.319$, $p = .282$	No Difference
Level of VB	Child No Responses	Spearman	$r(35) = .116$, $p = .508$	No Relation
Child Level of Verbal Behavior and Mother Interactions with Child				
Variable 1	*Variable 2*	*Analysis*	*Results*	*Significance*
Level of VB	Mother CU	ANOVA	$F(2,32) = .386$, $p = .683$	No Difference
Level of VB	Mother CU	Spearman	$r(35) = -.139$, $p = .425$	No Relation
Level of VB	Mother Non-vocal	ANOVA	$F(2,32) = 4.657$, $p = .017$	Significant Difference
Level of VB	Mother Non-vocal	Spearman	$r(375) = -.498$, $p = .002$	Mod/Low (–) Relation
Level of VB	Mother Att. Mands	ANOVA	$F(2,32) = .675$, $p = .516$	No Difference
Level of VB	Mother Att. Mands	Spearman	$r(35) = -.251$, $p = .145$	No Relation
Level of VB	Mother No Responses	ANOVA	$F(2,32) = 2.750$, $p = .079$	Marginal Difference
Level of VB	Mother No Responses	Spearman	$r(35) = -.026$, $p = .882$	No Relation
Level of VB	Mother Approvals	ANOVA	$F(2,32) = .980$, $p = .386$	No Difference
Level of VB	Mother Approvals	Spearman	$r(35) = -.104$, $p = .554$	No Relation
Level of VB	Mother Disapprovals	ANOVA	$F(2,32) = 1.897$, $p = .167$	No Difference
Level of VB	Mother Disapprovals	Spearman	$r(35) = -.258$, $p = .134$	No Relation

CHAPTER IV

GENERAL DISCUSSION

The rationale for conducting the current study on the vocal and non-vocal verbal behaviors emitted between preschool children diagnosed with autism and their mothers was to answer the following research questions: Were there relationships between a child's level of verbal behavior and various educational assessments? Were there relationships between the verbal behaviors emitted by the child with his/her mother during free-play sessions across the child's level of verbal behavior? Were there any relationships between the mother's emission of verbal behavior across the child's level of verbal behavior and mother's demographic variables?

Level of Verbal Behavior and Educational Assessments

The results revealed a significant relationship between children with autism's level of verbal behavior and the number of acquired C-PIRK objectives, the ADOS-2 modules used to assess the child's autism severity, and the communication behaviors based on the Vineland-3. These findings suggest children with ASD's performance on more universal educational assessments may be a valid indicator of children's level of verbal behavior and vice versa. This research study specified that children who function at a bidirectional level of verbal behavior acquire more communication and social repertoire objectives on the C-PIRK, have a higher adaptive behavior scale score on the VABS-3 and use the highest ADOS-2 Module to assess ASD severity. The children functioning at the pre-foundational level of verbal behavior acquire fewer C-PIRK objectives, have a lower adaptive behavior score, and required the lower ADOS-2 Module to assess ASD severity. These findings support previous VBDT research reporting that children with bidirectional capabilities such as naming, learn at a faster rate; thus, acquire more

language than children missing these essential repertoires (Greer, Corwin, & Buttigieg, 2011; Greer & Speckman, 2009; Hranchuck, 2016).

The ADOS-2 module and Vineland-3 are related to the tools used to measure verbal behavior cusps, capabilities, and foundational repertoires. Since the children's levels of verbal behavior were assigned using the results from the VBDA, the data also imply a relation between the VBDA, C-PIRK, ADOS-2 Modules, and the Vineland-3. The VBDA-R and C-PIRK are assessments developed by behavior analysts whose' focus is in the development of one's verbal behavior. The C-PIRK doubles as a tool to measure foundational repertoires necessary for children to access kindergarten independently, as well as a curriculum to teach those repertoires when missing using learn units. The VBDA-R assesses for missing verbal behavioral developmental cusps and cusps as learning capabilities when children are not acquiring C-PIRK repertoires through learn units. Since the C-PIRK targets a host of repertoires from academic skills to physical development, only the long-term objectives acquired in the communication and social repertoire sections were extracted. These sections focus on listener, speaker, social intraverbal, and social repertoires (e.g., following directions, imitating others, greetings, mands, tacts, conversational units, eye contact, vocal and non-vocal stereotypy). The ADOS-2 measures communication, reciprocal social interaction, and restricted and repetitive behaviors while the Vineland-3 assess for adaptive behaviors across expressive, receptive, and written language. Given the results of this study, it can be determined that the VBDA, C-PIRK, and Vineland-3 measures related verbal, social, and communication repertoires across children with ASD.

The ADOS-2 Module does not, however, function as an assessment tool to identify a child's ASD severity. The ADOS-2 severity score directly relates to a child's ASD severity across a spectrum of high, moderate, and low. The ADOS-2 Module is used to assess language

skills not within the child repertoire. Although the ADOS-2 Module demonstrated a relationship across each assessment and child's verbal behaviors emitted with the mother, the child's ADOS-2 severity score did not. These findings suggest that ASD severity may not be an indication of performance on some verbal behavior and educational assessments and a child's emission of verbal behavior across vocal, non-lexical, and non-vocal verbal behaviors. These findings further support Gotham, Pickles, and Lord (2009) stating the ADOS controls for children's verbal skills.

Level of Verbal Behavior, Assessments, and Child's Behavior with Mother

The relationships and differences between the verbal behavior children emitted with his/her mothers during free-play, the child's level of verbal behavior, and performance on the educational assessments were also compared. The results indicate that regardless of what level of verbal behavior children function at, how many social/communication objectives and adaptive behavior skills are within repertoire, children with ASD are attempting to communicate with her/her mother. This claim is supported by the data indicating there were no differences in the number of conversational units the children initiated across levels of verbal behavior; however, the differences fell within the *type* of verbal behavior the child emitted. Specifically, differences were shown in the emission of vocal, non-lexical, and non-vocal verbal behaviors.

More vocal verbal behaviors were emitted by children who had a more advanced level of verbal behavior, a higher number of objectives acquired in the C-PIRK, and Vineland-3 score. These results suggest vocal verbal behavior containing lexicons is a higher-order operant that requires more advanced cusps and capabilities to emit. Children functioning at the bidirectional level of verbal behavior have the necessary repertoires to engage in these higher-order social/verbal interactions with others (Greer et al., 2017; Greer & Speckman, 2009).

On the contrary, children who emitted more non-lexical and non-vocal verbal behaviors functioned at the pre-foundational level of verbal behavior, had a fewer number of objectives acquired in the C-PIRK, and a lower adaptive behavior score on the Vineland-3. The findings indicate that children attempt to communicate with his/her mothers regardless of level of verbal behavior, social/communication inventory. More specifically, the children with little to no social/verbal repertoires use non-vocal and non-lexical verbal behaviors to do so (Sigman et al., 1986).

There was a significant difference between the number of attempted mands the children emitted to the mothers across the levels of verbal behavior. The data indicated a curvilinear relationship between the levels of verbal behavior in which the pre-foundational and the bidirectional levels emitted the most number of attempted mands when compared to the middle, independent levels of verbal behavior. Specifically, children who function at the pre-foundational level of verbal behavior emitted the highest number of attempted mands compared to the independent listener and speaker level of verbal behavior. These results indicate that children without vocal verbal behaviors in their repertoire attempted to request their mother's attention or objects in the environment using non-lexical and non-vocal verbal behaviors. In turn, the mothers did not attend to or reinforce said requests.

Research suggests that mothers of neuro-typically developing infants respond to their child's gestures and translate the gestures into words, thus, facilitating the child's language development (Goldin-Meadow, Goodrich, Sauer, & Iverson, 2007). The findings in this study support these claims, as the differences in the social/verbal interactions were the *form* of verbal behavior the children emitted with the mother (i.e., words vs. sounds or gestures, or attempted words). These results suggest that mothers of children with ASD functioning at the pre-verbal

level of verbal behavior may not always view children's non-lexical or non-vocal verbal behaviors as attempts to communicate.

The results of the study also demonstrated the number of no-responses the child emitted (i.e., number of times they did not respond to their mothers) did not differ across the levels of verbal behavior as well as performances on the C-PIRK and educational assessments. Although the differences were not significant, a curvilinear relationship between the groups was demonstrated. These findings continue to support early research suggesting children with ASD direct as much attention to their mothers, as demonstrated by their attempts to communicate regardless of their lack of social/verbal repertoires (Sigman et al., 1986).

Data were collected across the emission of fantasy play for each dyad across observations of the pre-recorded free-play sessions; however, fantasy play was not a preliminary statistical variable and the data were only later added and analyzed. As a result of the late findings, there is not a review of literature on fantasy play reported; therefore, a visual representation of the results is reported in Appendix F. There was no significant difference shown across the emission of fantasy play by the children across the levels of verbal behavior; however, the data did demonstrate a linear pattern. These results indicate that fewer instances of fantasy play are emitted by children functioning at the pre-foundational level and a higher instance by children functioning at the bidirectional level. If the data were expanded (i.e., 5 levels rather than 3), the results would also show the children with fewer cusps or capabilities in repertoire did not engage in any instances of fantasy play. Furthermore, a strong relationship was demonstrated between the engagement in fantasy play and the number of acquired C-PIRK objectives and a moderately significant relationship with performance on the Vineland-3 communication domain.

The results suggest children with more communicative and social repertoires may engage in fantasy play with their mothers more often. These findings also demonstrate and support the notion that fantasy play may be a higher-order operant that requires the acquisition of more verbal behavior repertoires for one to truly engage (Eby & Greer, 2017; Greer et al., 2017; Lodhi & Greer, 1989; Schmelzkopf et al., 2017). The lack of difference in the emission of fantasy play across the levels of verbal behavior may be due to a lack of conditioned reinforcement for engaging in fantasy play. Regardless if the child can demonstrate the emission of conversational units with his mother using self-talk and say-do correspondence, the child or mother might have preferred to engage in other activities during the short observation period.

Level of Verbal Behavior and Mother's Interactions with Child

I investigated the associations between the verbal behavior emitted by the mothers across their child's level of verbal behavior. The results showed that the mother's verbal behavior emitted with her child mirrored the child's emission of verbal behavior. Specifically, mothers initiated conversational units with their children regardless of the child's level of verbal behavior as the children did. Mothers also reciprocated their child's non-vocal verbal behaviors across the three levels of verbal behavior. The mother's delivery of approvals and disapprovals varied across the child's level of verbal behavior; however, a higher number of approvals were delivered when compared to disapprovals. These findings support the longitudinal study on parent behavior toward their children diagnosed with ASD during play interactions, in which the parents synchronized their behaviors to their child's attention and activities as often as parents of neuro-typically developing children do (Siller & Sigman, 2002). These synchronizations by the mother, along with approvals may function to reinforce verbal/social interactions between one another.

A marginally significant difference was demonstrated across the mother's emission of no-responses to the child's verbal behavior. A difference between the three groups was not available; however, the data demonstrated a curvilinear relationship. If the data were expanded from 3 groups to 5, the results would indicate the mothers of children functioning at the listener level of verbal did not respond to their child as often as mothers of children functioning at the pre-foundational and bidirectional levels. The children functioning as listeners also initiated fewer instances of verbal behaviors overall (i.e., conversational units, non-lexical, and non-vocal verbal behaviors). The sample size of the listener level of verbal behavior was very small with only four participants, and therefore, further investigation is required to support these findings.

In relation, mother's emission of no-responses was analyzed across her level of educational experience. The results suggested that mothers with less educational experience may have emitted more no-responses to their child; thus, when comparing the mother's emission of no-responses, I controlled for both the mother's level of education and the listener level of verbal behavior separately. The results indicated: (a) controlling for mother's level of education, there was no correlation between her emission of no-responses across the listener level of verbal behavior, and (b) controlling for the listener level of verbal behavior, a strong relationship remained between the mother's level of education and her emission of no responses. The results suggest the mothers with lower levels of education may not respond as often to their children; thus, resulting in the punishment of verbal behavior for the children functioning at the listener level. The emission of no-responses was considered missed opportunities by the mother to engage in social/verbal interactions with her child. Due to the extremely small sample size of 2 representing the GED category, this analysis was not incorporated into the study. Further analysis with a larger, more evenly distributed sample size, is required to verify the results found

in this study. A visual representation of the results is reported in Appendix G.

Further investigation and replication of mother's level of education and no-responses may support Rowe (2008), suggesting parent income and level of education play a significant role in the child-directed speech during parent-child interactions. The more education a mother has, the more extensive vocabulary she might expose her child to, and in-turn, the more language the child may acquire. This notion is supported by the extensive body of literature identifying the significant role the parent plays in their child's acquisition of language (Clarke-Stewart, 1973; Goldstein et al., 2009; Hart & Risley, 1995; Snow, 1972). Specifically, the quantity of language, the more diverse and sophisticated vocabulary used, and the quality and clarity of mothers' speech patterns have a crucial effect on children's acquisition of language (Liu et al., 2003; Rowe, 2012). Due to these findings, some type of advanced education, or exposure of, is essential for parents to acquire various vocabulary skills necessary to assist in the development of their child's verbal behavior.

Additional findings were conducted but not included in this study: Mothers who reported having a low to median household income emitted significantly more approvals compared to low, median-high, and high household income with a curvilinear relationship. These findings mirror previous research indicating the negative effects a low household income may have on mother's emission of vocal verbal behavior (Tulkin & Kagan, 1972), and child-directed speech (Rowe, 2008). On the contrary, the findings may refute the literature on the verbal behavior emitted by mothers with higher household incomes; however, further analysis and replication are called upon in providing a better understanding of the results. A visual representation of the findings is reported in Appendix H.

Educational Implications

The findings in this study provide us with three key educational implications for children with ASD: (1) an interdisciplinary focus on assessing children with ASD (2) adds to the literature on the verbal/social development of children with ASD, and (3) further supports parents of children with ASD in the cultivation of their child's verbal behavior.

The first contribution of the study aligned a universal, diagnostic tool used to identify the severity of ASD in children with other assessments used in the analysis of verbal behavior. In doing so, the specific ADOS-2 module used to assess ASD severity, VBDA-R, the C-PIRK, and Vineland-3 assessments could essentially be applied interchangeably across disciplines. By identifying a relation between various educational assessments can assist in educational placements and provide a clearer picture of the child's social-communication skills sets. For example, if a new child is admitted to an ABA school with only ADOS-2 results. The behavior analysts may have a better understanding of what level of verbal behavior the child functions at, and therefore, appropriately place the child in a classroom based on the ADOS-2 module used until further assessments can be conducted. Furthermore, by aligning the assessments, the results may assist in a more global verification of the verbal behavior assessments used in the CABAS® model across educational disciplines. Although the CABAS® model is provided globally and there is immense data to support the educational effectiveness of children with ASD, its effectiveness is known on a rather trivial scale. By further verifying the VBDA-R and C-PIRK across disciplines, may result in further verification of the CABAS® model across disciplines.

The second contribution of this research is represented by (a) the support of previous findings on the verbal/social development of children with ASD, and (b) adding to the existing literature. The supportive contribution is demonstrated by the identification of how children attempt to communicate with their mothers through initiated conversational units regardless of

their level of verbal behavior (Sigman et al., 1986). The data collection method used in the study and results of said method add to the existing literature by specifying the types of verbal behavior humans use to socially interact -- vocal, non-lexical, or non-vocal verbal behavior. Contingent upon the child's verbal repertoire, the types of verbal behavior children with ASD use to initiate and respond with their mothers are indicated. This is particularly important for parents of children functioning at the pre-verbal level of verbal behavior, as they lack vocal verbal behavior and communicate with only non-lexical and non-vocal verbal behaviors (Stone et al., 2007). Clarifying the difference between non-verbal and non-vocal is paramount, as labeling a child "non-verbal," often used in cognitive psychology and normative education imposes a superficial stigma. This stigma implies the child does not have *any* verbal behaviors within his repertoire to attempt to communicate with another living being. This research supports the contrary and attests to (a) the notion that children, regardless of their verbal behavior repertoires, are attempting to socially interact with their mothers, (b) the importance of teaching parents to identify the types of verbal behavior their child may emit, and (c) further assist parents in the facilitation of reinforcing social/verbal interactions with their child as a result of attending to these behaviors.

To clarify any misconceptions of terms, such as the *conversational unit*, as it has a previous instructional history for disciplines outside of VBDT. The term has a connotation that implies the emission of *words* around a particular topic (i.e., the layman's term "conversation" as in, "We had a conversation about what colleges to apply to"). The exchange of conversational units between two organisms does not have to involve the use of lexicons or follow a logical basis. The term *verbal* represents a variety of behaviors emitted across vocal, non-lexical, or non-vocal verbal behaviors with the function to communicate to another organism or aloud to

oneself. The volleys of listener and speaker responses can occur across endless variations. For example, conversational units can rotate between you and your dog when he whimpers and nudges his bowl toward you as a non-lexical and non-vocal mand for food, you fill the bowl with food, and the dog eats. Or, when the aide asks a hard-of-hearing elderly lady, "What do you want to eat?" the women replies, "Don't touch my feet," followed by the aid rolling her eyes and putting a glob of mashed potatoes on the plate. Although the emission of lexicons can be synonymous with vocal communication and language, non-vocal and non-lexical verbal behaviors also have a function to communicate, and therefore, need to be "heard."

The last contribution further supports the parents of children with ASD in the cultivation of their child's verbal behavior. The recruitment letter sent out to parents read, "Improving Parenting and Enhancing Maternal Wellbeing in Mothers of Preschool Children." The title alone emphasizes the original purpose of this study designed by Jarohmi, Brassard, Dudek, and Greer (2016). Due to the findings in this research, I sought to assist in the accomplishment of the researchers' ultimate-goal by providing further support to parents of children with ASD in the progression of their child's verbal behavior, namely, across the identification of non-lexical and non-vocal verbal behaviors. Tomasello argues that language acquisition is a result of the ability to emit joint intentionality with others. Engaging in shared attention with others by following gaze directions, imitating actions, and redirecting attention through pointing results in children emitting early signs of language comprehension (Tomasello, 2000, 2008). From a behavior analytic perspective, language acquisition begins with conditioned reinforcement for the emission of observing responses, which leads to visually tracking 3D stimuli, and the generalization of imitation of the actions of others (Keohane et al., 2009). The actions of joint attention and observing responses are the definition of non-vocal verbal behaviors.

Non-lexical vocal verbal behaviors are first observed in infants, and the literature supports mothers' vocal imitations of said vocalizations as a function of reinforcement (Pelaez et al., 2011b). When infants with ASD physically develop and age, their verbal behavior may not develop in a simultaneous fashion as does for neuro-typically developing infants, as explained by Greer (2008). The acquisition and emission of lexical vocal verbal behavior may be impaired for individuals ranging from young children to adults who have been diagnosed with ASD or other developmental disorders. As a result, the emission of non-lexical vocal verbal behavior along with non-vocal verbal behavior plays a significant role in children with ASD attempting to communicate with others.

For parents, knowing how to simply identify the different types of verbal behaviors as communication and therefore respond to their child, can function to reinforce parent-child social/verbal interactions. In conjunction with the identification and reinforcement of non-lexical and non-vocal verbal behaviors, the cultivation of their child's verbal behavior development (as opposed to their chronological age) is paramount. The results of the study suggest a call to action for educating parents on their child's verbal behavior development, and likely the need for mothers with a lower level of educational background. Providing educational opportunities for theses mothers may result in an increase of responses to their child's verbal behavior. Suskind and colleagues (2015), provided parents with vital information to assist in the development of their child's social/verbal behavior: tune in to what your child is doing, talk more to your child, and take turns engaging in conversations. Similarly, the World Health Organization (1997) suggested three guidelines for parents to follow: (1) talk to your child through means of expressions, gestures, and sounds, (2) follow your child's lead, (3) and praise your child (i.e., deliver approvals).

Regarding the latter guideline as proposed by WHO (1997), the findings in this study have future potential to support the education of mothers on the reinforcement value approvals could have on the emission of communicative behaviors. Greer (2002) described how the behavior analytic tactic of increasing behavior- and child-specific approvals delivered by teachers sets up the Sd (i.e., appropriate child behaviors) for teachers to identify and reinforce their students' appropriate behaviors. As a result, appropriate behaviors increase, while inappropriate behaviors decrease. For teachers to consistently and contingently identify appropriate behaviors and emit corresponding approvals, 2-4 approvals should be delivered every minute. Once fluent, the rate of approvals can decrease, as an instructional history of identifying appropriate behaviors and reinforcing said behaviors has been established (Greer, 2002). With further research and replications, the findings in this study have potential to support mothers from lower household incomes in increasing the number of approvals delivered to their child.

Developmental psychologists report that person-directed praise, as opposed to activity-directed praise, leads to higher achievements, an increase in motivation, and decrease in avoidance behaviors (Pomerantz & Kempner, 2013). One could interrupt that as mothers who spend time with their children have more opportunities to endorse, commend, and emit child-directed praise for correct or desired behaviors. These actions may function to reinforce the behavior of children who demonstrate conditioned reinforcement for adult attention; and in turn, the establishment of adult social attention as a reinforcer for preschoolers can function to increase social/verbal interactions with others (Eby & Greer, 2017; Schmelzkopf et al., 2017). Giving parents this knowledge in conjunction with their child's level of verbal behavior development, can allow them to (a) identify, approve, and reinforce their child's verbal behavior,

(b) understand their child's limitations, and (c) cultivate those limitations into a further progression of their child's verbal developmental repertoires.

Limitations

A major limitation of this study was the sample size across some of the variables analyzed. The sample was recruited years before the current study was drafted. Due to a pre-determined sample size, there was no opportunity to control for the sample in each level of verbal behavior across each dependent variable. This had a direct impact on the reliability of some analyses (e.g., the effects of mother's level of education and on approvals) as the results could not be replicated across multiple mothers.

A second limitation of the study involved the data collected across the C-PRIK assessments. This assessment was administered before conducting the video procedure by the child's classroom teacher who was blind to study's occurrence. Due to the data collection procedures of these variables, I did not have IOA for the collection of any of the behaviors measured. Three of the participants' C-PIRK data showed the results might have been incomplete, as data for some repertoires were missing (i.e., the child exhibited a behavior on one assessment but results for the *same* behavior were missing for another assessment). These missing results may have demonstrated an inaccurate representation of the child's performance and were therefore not reported.

The final limitation of the study consisted of ADOS-2 severity scores and Vineland-3 scores. The scores extracted from these educational assessments do not represent a fracture of countable, measurable units of behaviors as exhibited in learn unit presentations (Albers & Greer, 1991). A learn unit is a natural fracture of pedagogy that is demonstrated by an instructional presentation involving multiple three-term contingencies (antecedent – behavior –

consequence) between and a child and teacher (Albers & Greer, 1991; Greer, 1994; Greer, 2002; Hranchuk, 2016). The C-PIRK and VBDA-R assessments use learn units to measure countable units of behaviors, while the Vineland-3 may assess skills through parent or teacher hypothetical opinions. As a result of the opposing procedures, one could argue these variables may not be comparable to one another.

Future Research

According to the literature of DeCasper and Fifer (1980), one could argue the children in this study engaged in conversational units at a paralleled frequency across the varying levels of verbal behavior due to the child's mother being the target audience. As a result, future studies should seek to replicate this study with the child's teachers, peers, or less prominent figure. The results may indicate a more accurate measure of the child's verbal behavior repertoire and social/verbal interactions.

Due to the small sample size of this study across variables, future studies should select variables of interest and recruit mother-child dyads specific to variables and further replicate the findings herein. Specifically, focusing on the analysis of mother's no-responses to their children with ASD. We learned the child's level of verbal behavior might not be the leading indicator of a higher emission of no-responses by the mother. We did learn, however; the mother's level of education may be a factor. As a result, one could recruit a large sample size of mothers of preschool children with ASD with a specific educational level (e.g., mothers with GED and college graduates). You would then control participant recruitment of each educational level to provide an evenly distributed sample size across the groups followed by collecting data across mothers no-responses her child's verbal behavior.

Regarding the emission of no-responses by the mothers, future studies might profit from identifying the reinforcing and punishing contingencies between the conversational units emitted across the mothers and their children with ASD. Analyzing the reinforcing and punishing contingencies across sequential dyadic responses would not be optimal for accurate measurement, as the various listener or speaker responses occur intermittently across conversational units; and therefore, results in inconsistencies in the isolation of the functional relations. Gertwiz and Pelaez (1992) propose for researchers to experimentally contrive the settings and control either the parent or child's responses to identify the reinforcing or punishing functions of the conversational units for one member in the dyad at a time.

The results of this study support the importance of capturing the social interactions in their entirety; and therefore, data collected on verbal operants in the classroom may benefit from collecting data across each form of listener and speaker responses in a rotated fashion to capture each conversational units and no-responses emitted with a peer. This data collection procedure would primarily benefit children functioning at the pre-foundational and listener levels of verbal behavior, as they emit fewer instances of vocal verbal behavior.

The results of the study also call for the redefining of listener and speaker responses, specifically, the form of the responses: A speaker response is defined as the emission of vocal verbal (lexical or non-lexical) and non-vocal verbal behaviors in an attempt to initiate or respond to a listener within a social/verbal interaction. An initiated speaker response functions as an Sd for a listener to respond and a speaker response to a listener functions as reinforcement for the listener's verbal behavior. A listener response is defined as the emission of vocal verbal (lexical or non-lexical) and non-vocal verbal behaviors and acts to consequate (reinforce or punish) the behavior of a speaker. If the listener response functions to punish the speaker's behavior, the

social/verbal interaction concludes. If the listener response acts to reinforce the speaker's behavior, the exchange continues and the second speaker response functions to reinforce the initial listener response. If the speaker and listener responses continue to reinforce one another, the social/verbal interactions continue in a rotated fashion until a no-response occurs.

Children functioning at the foundational level of verbal behavior have conditioned reinforcement for observing people and stimuli in their environment; although, they do not have the necessary listener discrimination repertoires needed to follow vocal directions without a stimulus prompt. When parents do not have this background knowledge and emit vocal directions without a visible prompting, the result is either a no-response or incorrect response by the child, and a higher likelihood of parent coercive behaviors. Similarly, if a child functioning at the pre- foundational level of verbal behavior turns his head away when a stimulus is present (i.e., non-vocal mand for "No"), or the child walks toward the parent holding a new object (i.e., non-vocal mand, "I want what you have"), this is the child's pre-lexical way of communicating, and thus, requires appropriate parent repertoires to be identify. Ideally, a parent with these repertoires would have an advantageous effect on future parent-child interactions, especially for children with ASD.

The results of the study may indicate a relation between joint attention and observing responses, as they were both emitted across non-vocal verbal behaviors; however, this study did not directly measure joint attention as defined in the literature. Future studies should consider measuring the emission of joint attention across the dyads and compare the results to the child's emission of non-vocal verbal behaviors.

There is a vast field of research contributing to the acquisition and effects of joint attention for infants with and without disabilities, while the area of observing responses, as

defined by VBDT, for infants remains theoretical and empirically non-existent. The findings of this study support the indispensable role observing responses play in the communication of children with ASD. Future VBDT research should focus on the acquisition and effects of infant observing responses. Specifically, to (a) demonstrate the emission and progression of observing responses between infants and their mothers beginning at birth, (b) identify the longitudinal effects these social/verbal interactions have on a child's verbal behavior development across neuro-typically developing children and children with ASD, and (c) pinpoint when humans begin to emit verbal behavior. The implications of these future studies may act to strengthen the current research demonstrating the significance of reinforcing mother-child social/verbal interactions beginning at birth (Goldstein et al., 2009; Pelaez et al., 2011a, 2011b).

Conclusion

When interpreting the basic framework of communication through the observation of the initial speaker responding back to the listener, the results pinpoint the moment at which this symbiosis relationship becomes a conversational unit. VBDT proposes how this verbal interaction is the foundational development of what we know as social communication and language. This study empirically captures the specific *forms* of verbal behaviors involved within a conversational unit, and fully demonstrates both the listener and speaker roles emitting and contacting the reinforcing contingencies of one another. Identifying the various forms of verbal behaviors that listeners and speakers emit to communicate, provides a small, yet necessary step toward learning how to better cultivate the social/verbal interactions of children with ASD.

Skinner stated, "… any movement capable of affecting another organism may be verbal" (1957, p. 14). For centuries we have accepted apes beating their chest, man's cave paintings, Egyptian hieroglyphics, and Native American smoke signals as various means to communicate.

The findings of this study support Skinner's claim demonstrating the impact non-vocal and non-lexical verbal behaviors have on social communication between organisms, and most importantly between children with ASD and their mothers. This is the century we begin to acknowledge and reinforce the head turns, points, and grunts emitted by pre-lexical children and adults with disabilities as their means to communicate; all the while, fostering those forms of verbal behaviors into vocal-lexical verbal behaviors.

Research supports the notion that children are born observing and contacting the stimulus control of their mothers' voice over others. As children develop, these vital interactions are instrumental to the success of their overall verbal development. For children with ASD, social/verbal interactions with their mothers are even more invaluable. I hope the findings of this study create a motivating operation for mothers and caregivers to contingently acknowledge and respond to their child's verbal behavior, in all their forms.

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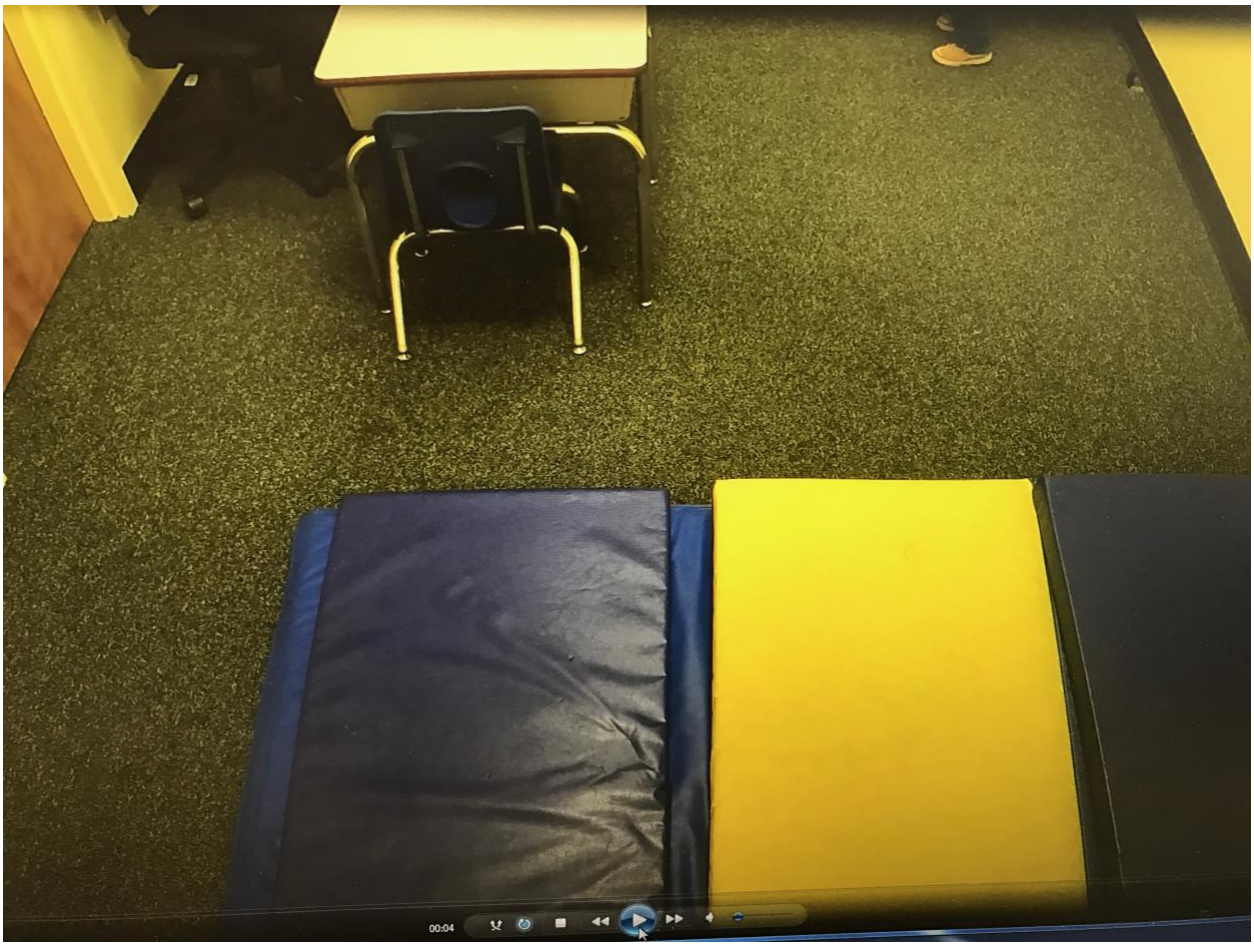
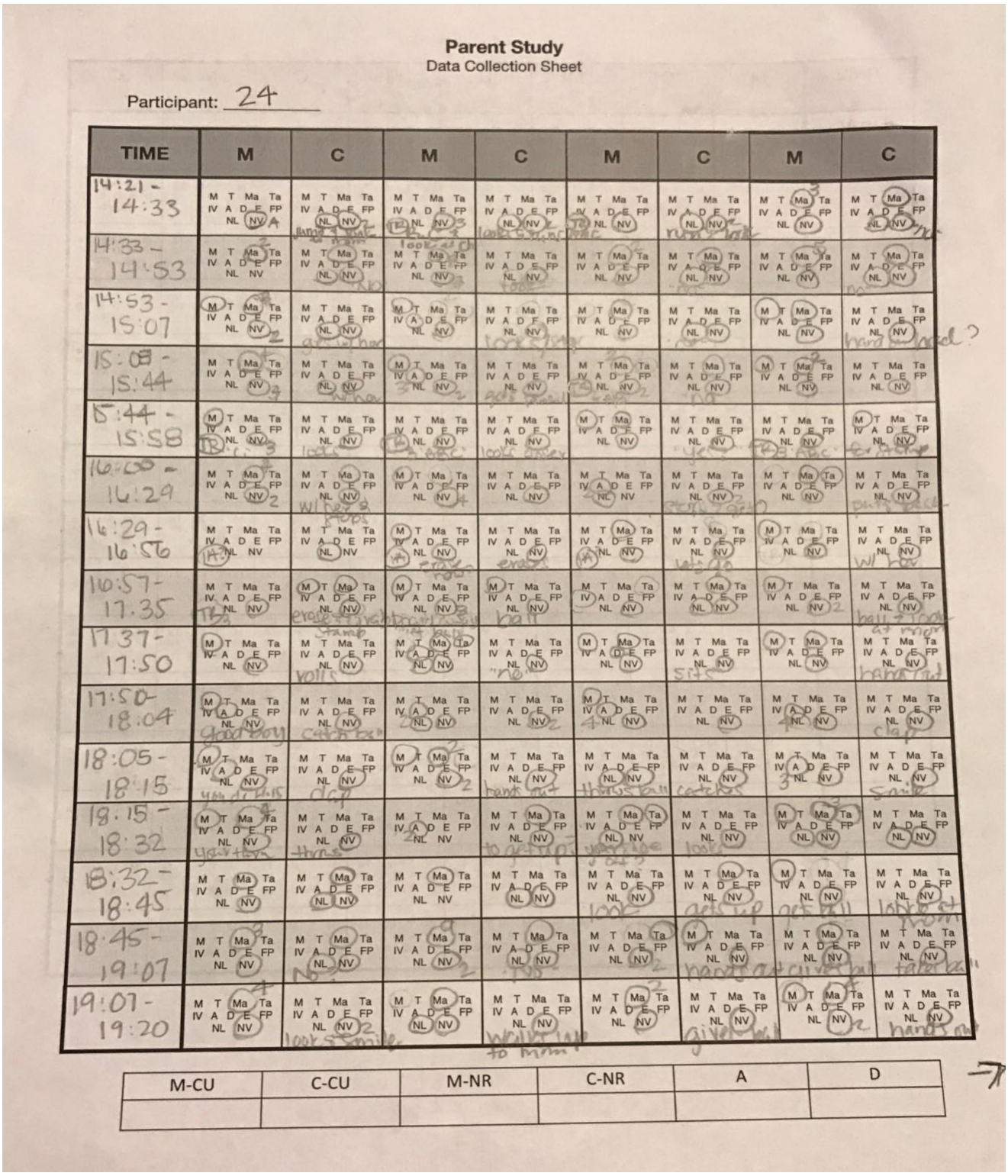
Appendix A

Free-play setting.



Appendix B

Example of a completed data sheet.



Parent Study
Data Collection Sheet

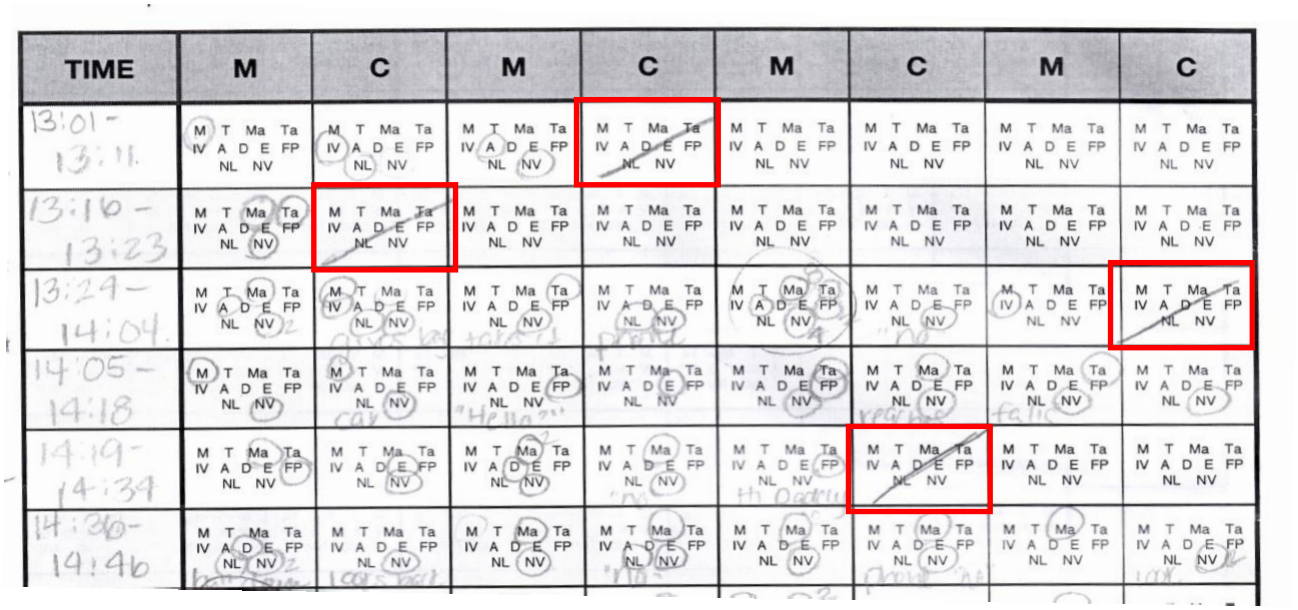
Participant: 24

TIME	M	C	M	C	M	C	M	C
14:21 - 14:33	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
14:33 - 14:53	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
14:53 - 15:07	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
15:08 - 15:44	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
15:44 - 15:58	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
16:00 - 16:29	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
16:29 - 16:56	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
16:57 - 17:35	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
17:37 - 17:50	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
17:50 - 18:04	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
18:05 - 18:15	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
18:15 - 18:32	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
18:32 - 18:45	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
18:45 - 19:07	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
19:07 - 19:20	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV

M-CU	C-CU	M-NR	C-NR	A	D

Appendix C

Example of a completed data sheets indicating the emission of no-responses.

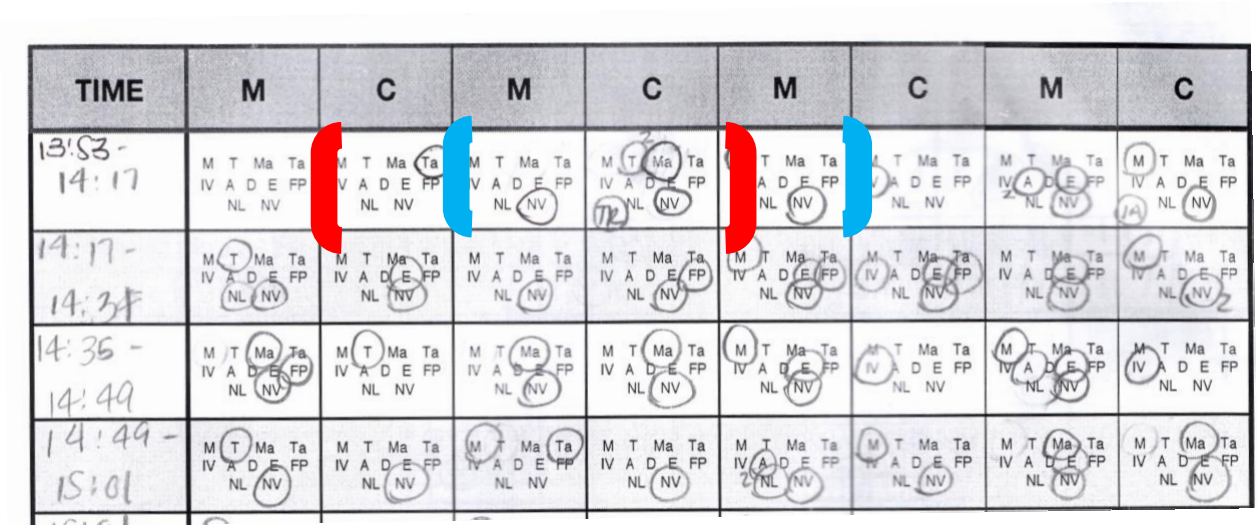


TIME	M	C	M	C	M	C	M	C
13:01 – 13:11	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
13:16 – 13:23	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
13:24 – 14:04	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
14:05 – 14:18	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
14:19 – 14:34	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
14:36 – 14:46	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV

Note. Red boxes represent a no-responses emitted by a participant. This example data sheet indicates the no-responses were emitted by the child.

Appendix D

Example of a completed data sheets indicating mother- and child-initiated conversational units.



TIME	M	C	M	C	M	C	M	C
13:53 - 14:17	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
14:17 - 14:34	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
14:35 - 14:49	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV
14:49 - 15:01	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV	M T Ma Ta IV A D E FP NL NV

Note. Red brackets represent a child-initiated conversational unit rotating C – M – C responses. Blue brackets represent a mother-initiated conversational unit rotating M – C – M responses.

Appendix E

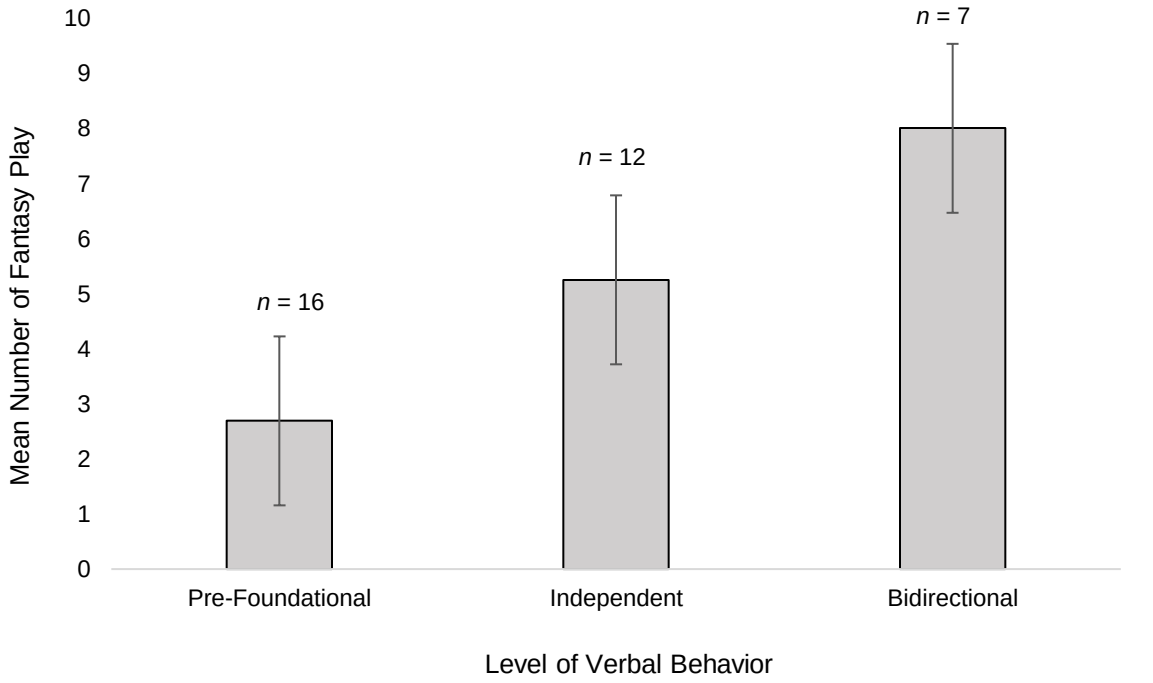
Vocal, non-lexical, and non-vocal examples across each verbal operant.

Verbal Behavior	Controlling Variable(s)	Speaker Response	Listener Response
Tact			
Pure tact	(non-vocal Sd) visually sees a (non-verbal Sd) doll	"Doll!"	"That's a pretty doll."
With *generic* extension	(non-vocal Sd) visually sees a (non-verbal Sd) car drive by	"That is a yellow car."	"That is a big yellow car."
With *metaphorical* extension	(non-vocal Sd) visually sees child put (non-verbal Sd) shape in the correct slot	"Okay" or "That's where it goes."	Child moves on to next shape
With *metaphorica*l extension	(non-vocal Sd) visually sees child drop a (non-verbal Sd) ball	"Oh man."	Child picks ball up
Non-vocal	(non-vocal Sd) visually sees (non-verbal Sd) person walk in	Person smiles and nodes as *Hi*	Person makes eye contact and smiles back
Tact Episode	(non-vocal Sd) visually sees a rainbow of (non-verbal Sd) multiple colors	"Red, blue, purple, green, red, orange, yellow, a rainbow."	"Yes, a rainbow!"
Attempted Tact	(non-vocal Sd) visually sees a (non-verbal Sd) ball and picks it up	"Ball!"	*No response and/or changes subject*
Mand			
For Information *Vocal*	(non-vocal Sd) visually sees a (non-verbal Sd) unknown object and (MO) wants to know the name of the object	What is that?" (while pointing to the unknown object)	"A light switch."
For Object or Activity *Vocal*	(non-vocal Sd) visually sees a (non-verbal Sd) iPad and (MO) wants to play with it	"Can I play with the iPad?"	"Not right now."
Non-lexical and Non-vocal	(non-vocal Sd) visually sees a (non-verbal Sd) iPad and (MO) wants to play with it	Points to iPad and grunts	Parent gives child iPad
For Attention *Vocal*	(non-vocal Sd) parent attending to a task and (MO) child wants parent to attend to them	"Hey mom, look at what I can do."	Parent looks at child (can or cannot emit a vocal response)

Non-vocal and Non-lexical	(non-vocal Sd) parent attending to a task and (MO) child wants parent to attend to them	Child walks over to parent, tugs on shirt, and grunts	Parent looks at child (may or may not emit a vocal response)
As a Demand *Vocal*	(non-vocal Sd) child playing with cars instead of cleaning up and (MO) parent wants child to clean	"Let's put all the cars in the bag."	Child puts cars in bag
Non-vocal	(non-vocal Sd) child running around room and (MO) parent wants child sit in chair	Parent makes eye contact with child and points to chair	Child sits down
Attempted Mand	(non-vocal Sd) visually sees (non-verbal Sd) ball	"Ball, ball, ball!" and throws it at toward mom	*Doesn't catch ball and says, "No, let's just color"*
Echoic	(vocal Sd)	"Cat."	"Cat."
Attempted Echoic	(vocal Sd)	"Cat."	"Ca"
Intraverbal	(vocal Sd) mand for information	"What time is it?"	"3:00."
Impure intraverbal tact	(vocal Sd) mand for information	"What shape is this?"	"Triangle."
YES *Vocal*	(vocal Sd) mand for information	"Is this a green car?"	"Yes."
Non-vocal	(vocal Sd) mand for information	"Do you want to color?"	Shakes head up and down as *Yes* and reaches for paper
NO *Vocal*	(vocal Sd) mand for information	"Can you write your name yet?"	"Umm No."
Non-vocal	(vocal Sd) mand for activity	"Let's play catch" and throws ball toward child	Turns body away from ball or shakes head side to side as *No*
Textual Response	(non-verbal Sd) word truck is written in a book	Speaker reads "truck."	"Truck." (overt)
Textual Response Episode	(non-verbal Sd) numbers 123 and letters ABC painted on wall	Speaker reads 1, 2, 3, A, B, C	"1, 2, 3, A, B, C." (overt)
Fantasy Play *Vocal*	(non-verbal Sd) baby doll	"Shhh, baby Abigail is sleeping."	(whispers) "Sorry Abigail! Sweet dreams."
Non-vocal and Non-lexical	(non-verbal Sd) toy car	"Vrroooom" (racing car)	"My car is faster. Vroooom"

Appendix F

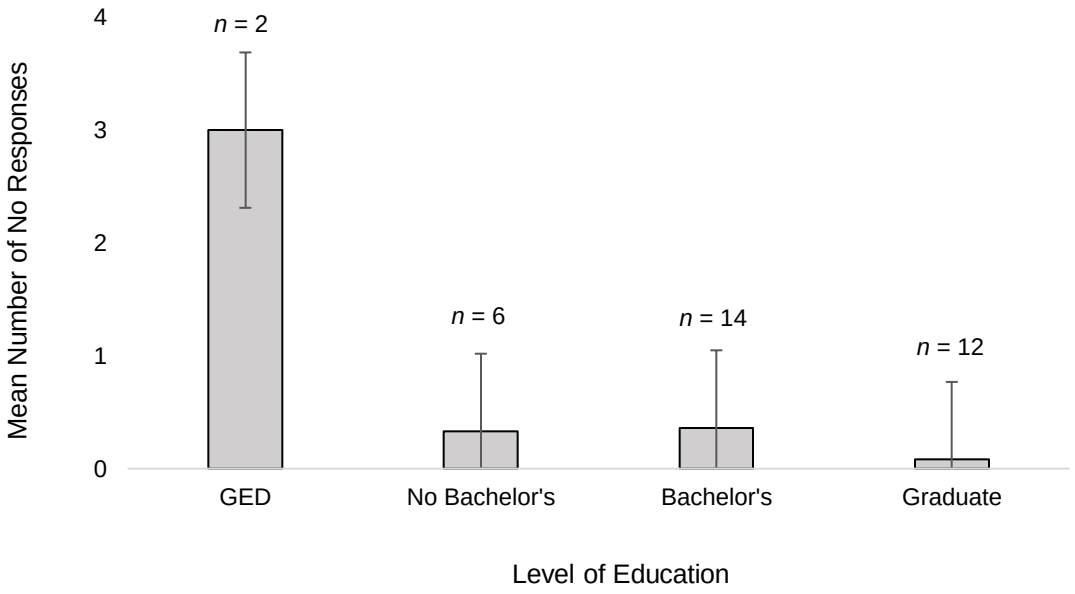
Child's emission of fantasy-play with the mother across each level of verbal behavior.



Note. No significant difference, $F(2,32) = 2.434$, $p = .104$, with a post-hoc indicating a marginal significant difference between the bidirectional and pre-foundational levels of verbal behavior, $SE = 2.469$, $p = .095$. A bivariate correlation demonstrated a marginal significant relationship with the child's level of verbal behavior (nonparametric), $r(35) = .315$, $p = .065$; a moderate significant association with the C-PIRK (nonparametric), $r(35) = .559$, $p = .001$ and VABS (nonparametric), $r(34) = .556$, $p = .001$.

Appendix G

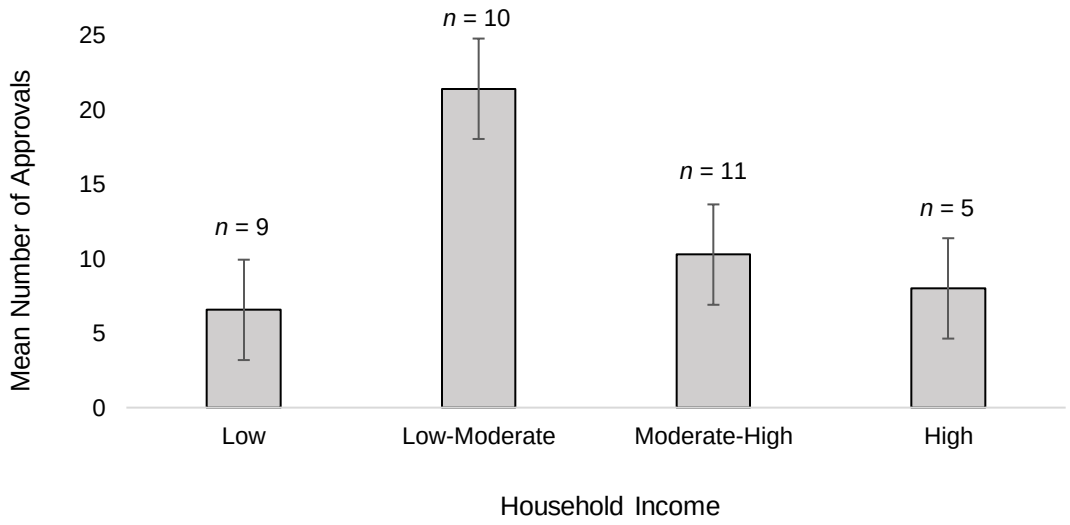
Mother's level of education and no-responses to child.



Note. Significant difference, $F(2,30) = 7.589$, $p = .001$, with a post-hoc indicating the significant differences were between the mothers with GED and no bachelors, $SE = .658$, $p = .002$, GED and bachelors, $SE = .609$, $p = .001$, GED and no graduate, $SE = .615$, $p = < . 001$. A nonparametric correlation demonstrated a moderate to low significant association between the mother's level of education and her no-responses, $r(34) = -.394$, $p = .021$.

Appendix H

Mother's household income and approvals delivered to child.



Note. Significant difference, $F(3,31) = 5.050$, $p = .006$, with a post-hoc indicating the significant differences were between the mothers with mid/low and low-income, $SE = 4.194$, $p = .007$; mid/low and mid/high-income $SE = 3.988$, $p = .042$; and mid/low and high-income $SE = 4.999$, $p = .054$ (marginal). A nonparametric correlation did not demonstrate a relationship between mother's income and approvals, $r(35) = .006$, $p = .971$.