April 2020

THE RELATIONSHIP BETWEEN THE DEVELOPMENT OF COMMUNICATIVE FUNCTIONS IN CHILDREN WITH AUTISM SPECTRUM DISORDERS

Isabelle Bankston
Louisiana State University and Agricultural and Mechanical College

THE RELATIONSHIP BETWEEN THE DEVELOPMENT OF COMMUNICATIVE FUNCTIONS IN CHILDREN WITH AUTISM SPECTRUM DISORDERS

A Thesis

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Masters of Arts

in

The Department of Communication Sciences and Disorders

by
Isabelle Marie Bankston
B.S., University of Texas at Austin, 2018
May 2020

ACKNOWLEDGMENTS

This thesis would not have been achievable without the continuous encouragement and assistance from my supportive committee, family, and friends. I extend the greatest gratitude to my thesis committee, Dr. Daphne Hartzheim, Dr. Eileen Haebig, and Dr. Janna Oetting for their consistent time and consideration for this project. The feedback and understanding of this research project will never go unnoticed. Dr. Hartzheim, thank you for putting forth the effort to never give up on me and this study. I genuinely appreciate everything you have done for me since the beginning. To my parents, thank you for the constant support throughout the process of me attaining my dreams of becoming a Speech-Language Pathologist. I cannot believe that I am doing what I told you I wanted to do since I was a teenager in just a few short months. Without you, none of this would be possible. To my boyfriend and number one fan, thank you endlessly for the encouragement and loyalty to me to accomplish all of my professional goals. I cannot express enough gratitude to all these people that have allowed me to be where I am today. Many thanks.

TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

In regard to the assessment of language, it is difficult to determine exact communicative functions that are exhibited early in development that could indicate a prognostic value of verbal abilities and outcomes of children with autism spectrum disorder (ASD). The *Verbal Behavioral Milestones Assessment and Placement Program* (VB-MAPP, Sundberg, 2008) is frequently used in Applied Behavior Analysis for standard assessment procedures to measure development over time. The current study was designed to use the VB-MAPP to determine a relationship between certain communicative functions (i.e., mand, tact, listener responding, echoic, and intraverbal) that may suggest a correlation in growth in each function. Findings allow clinicians to understand what to target in order to promote growth in a large array of functions. Scores from children with ASD from the VB-MAPP (N=15) were analyzed to determine the relationship between the development of communicative functions (i.e., mand, tact, echoic, listener, and intraverbal operants).

Correlations were found to be significant in the development of the skill to mand with the development of skills in tacting, listener/receptive, and echoic/verbal imitation. Nonetheless, there was no correlation found between the participants' development in manding and the increase in intraverbal skills. However, there were correlations between the development of tacting, listener/receptive, and echoic with intraverbal growth.

The lack of relationship between mand and intraverbal suggests that a child's increase in knowing how to mand does not necessarily show an increase in skills in intraverbal capabilities. The findings also highlighted the relationship between the development of other communicative functions selected from the VB-MAPP suggests several correlations in regard to an increase in each domain, aside from mand and intraverbal.

CHAPTER 1.
INTRODUCTION

Language and communication development is a critical measure in a comprehensive assessment for autism spectrum disorder (ASD) and essential to establishing an intervention plan. The language and communication skills can be assessed by Speech-Language Pathologists in the context of form (i.e., phonology, morphology, syntax, and semantics) as well as communicative functions (e.g., requesting, protesting, initiation, greeting, imitation, narration, etc.). This study focuses on Skinner's (1957) analysis of language in regard to individuals with ASD, and communicative functions are referred to as verbal operants. Studies of language predictors in children with ASD often focus on the changes in forms of communication (i.e., gestures, phonemes, semantics, morphology, and syntax, etc.). The importance of discovering the relationship between each communicative function will allow for expanding insight into how an individual with ASD learns and develops regarding language and communication. Children with ASD produce their first words at an average age of 36 months compared to children with typical development who produce first words between 12 to 18 months of age (Howlin, 2003; Tager-Flusberg et al., 2009; Zubrick et al., 2007). Roughly 25% of individuals with ASD remain non-verbal or minimally verbal over the entirety of their lives (Lord, Risi, & Pickles, 2004). Children with ASD who develop verbal communication skills generally reach language milestones in a similar progression to typically developing children although delayed. Furthermore, research indicates that children with ASD who had "useful speech" by age 5 established more social skills and required fewer support services. In a more recent study, data suggested that children with an ASD diagnosis who are producing 10 words by 18 months are linked to better later functional outcomes (Howlin et al., 2004). In addition to these language milestones, the acquisition of first words and age of first phrases have predicted further

developmental outcomes (Mayo, Chlebowski, Fein, & Eigsti, 2013; Kenworthht et al., 2012). Along with language predictors, individuals with ASD struggle with social communication and children with ASD produce relatively less communicative acts/gestures and joint attention than typically developing children (Shumway & Wetherby, 2009). These studies indicate that there is some understanding regarding which language forms predict later language outcomes. However, research is lacking in understanding how language functions or communicative functions are developing and if a relationship between different functions exists. This current study investigated the significance and clinical application of a verbal behavior approach to language for individuals with ASD. (Sundberg & Michael, 2001; Carr & Firth, 2005; Sautter & LeBlanc, 2006). The *Verbal Behavioral Milestones Assessment and Placement Program (VB-MAPP)* quantifies milestones or communicative functions (i.e., mand, tact, echoic and intraverbal) for individuals with ASD. In addition, the VB-MAPP examines specific restrictions that can be detrimental to the child's ability to learn language, which is characterized as barriers. This current study sought to determine if there is a relationship between verbal operants or communicative functions (i.e., mand, tact, listener, echoic, and intraverbal) identified via the VB-MAPP for children with ASD over time.

Autism Spectrum Disorder

The diagnostic criteria for an ASD diagnosis are comprised of persistent deficits in social communication, and restricted interests and repetitive behaviors (American Psychiatric Association, 2013). Regarding social communication, impairments of reciprocity/initiation of social or emotional interaction, severe difficulties maintaining and developing relationships, and nonverbal communication problems are observed. Characteristics of restricted and repetitive behaviors include two of the four areas: 1) stereotyped/repetitive movements, 2) extreme

adherence to routines or patterns 3) highly restricted interests that are atypical and 4) hyper- or hyporeactivity to sensory input. These symptoms commonly present during the early stages of development and may not become entirely manifested until more social demands are introduced (Autism Speaks; APA, 2013). Due to the variability of these deficits, symptoms may manifest differently in each individual with ASD. Several individuals with ASD also exhibit difficulty in speech, nonverbal communication, and most, but not all, present with some form of language disorder (Kjelgaard & Tager-Flusberg, 2001).

The most recent consensus states that 1 in 59 children have a diagnosis of ASD and that it is found in all racial, ethnic, and social groups across the world (Baio et al., 2018). The Center for Disease Control and Prevention (CDC) found that males are around four to five times more likely to be diagnosed than females (CDC; Baio, 2018). ASD manifests very differently in each individual. Although a language disorder is not a defining trait of ASD, problems in language and communication are often first signs (Kurita, 1985; Lord & Paul, 1997). When language is affected, language impairments can occur in pragmatics, morphology, syntax, semantics and/or prelinguistic communication, but with varying degrees. Comorbidity of language impairment in ASD is common, and regardless of the presence of a language impairment, all children with ASD have social communication (pragmatic) difficulties.

According to the American Speech-Language-Hearing Association (ASHA), Speech-Language Pathologists are essential in the process of assessment and treatment of speech and language deficits in children with ASD and this includes providing support in functional communication through therapy and implementation of augmentative and alternative communication (AAC). Defining and recognizing early risk factors and prognostic indicators in children with ASD is crucial for diagnosis and intervention (Luyester, Seery, Talbott, & Tager-

Flusberg, 2011). Determining the individual history of language learning is critical in the assessment and diagnostic process of children with ASD but it does not accurately provide a predictive function for language development (Howlin, Goode, Hutton, & Rutter, 2004). Osterling and Dawson (1994) studied home videotapes of children who were later diagnosed with ASD and found that these children exhibited less social and communicative behaviors. The lack of behaviors that correlated with the classification of ASD was pointing, showing objects, visual attention, and orienting to name. Language functions were not included in the analysis.

Language and Communication in Children with Autism

Around three-quarters of the ASD population develops expressive language in some way, however, at a slower rate (Le Couteur, Bailey, Rutter, & Gottesman, 1989). In contrast, the other 25% of the population with ASD will not develop functional speech and remain nonverbal (Lord et al., 2004). Language and communication development in young children with ASD is a complex process and attention has shifted towards the emergence of language, more specifically intentional social communication (Sandbank, 2017). Shumway and Wetherby (2009) found that typically developing peers develop intentional communication at a significantly higher rate than children with ASD. Delays in language, accompanied by deficits in social and intentional communication, is often shown in children with ASD. These social communication or pragmatic deficits include difficulty in conversational skills like turn-taking, gesture usage, appropriate speech, and difficulties understanding topics that are interesting to their conversational partner (Paul, 2008). The reduced use of intentional communication in individuals with ASD often results in the inability to understand the world and social relationships and everyday life. Social and intentional communication falls under the intraverbal verbal operant in regard to Skinner's verbal operants. The intraverbal operant is any type of verbal response, of a different manner, to

a previous verbal stimulus. As stated by Skinner (1957), learning to respond exclusively to the verbal behavior of another speaker, via intraverbals, is crucial to navigating and sustaining social conversations (Skinner 1957).

Typically, children with ASD have difficulty engaging and initiating joint attention skills. Joint attention can be classified into two distinct categories 1) response to joint attention (RJA) and 2) initiation of joint attention (IJA). Individuals with ASD exhibit deficits in both components of responding (i.e., response to the parent or caregiver's attention or shift in eye gaze) and initiation of attention (i.e., child's seeking another's attention through eye gaze, pointing, or gestures). Several studies also suggest that the ability to respond to joint attention and supported joint engagement influence the language development of both TD toddlers and young children with ASD (Bruinsma, Koegel, & Koegel, 2004). The inability to attend to another person impacts an individuals' ability to function independently in several areas of life, therefore, joint attention is important to assess in individuals with ASD. Joint attention was found to be a good predictor of concurrent language development (Dawson, Toth, Abbott, Osterling, Munson, Estes, & Liaw, 2004). Children with ASD are expected to use similar word acquisition skills as their typically developing peers, though less effectively, which causes a delay in the intake of language input. This delay thus hinders the development of word acquisition (Arunachalam and Luyster, 2016). Therefore, joint attention most likely provides a predictor in the acquisition of spoken language. The development of joint attention is most likely correlated with language acquisition stages because joint attention is a pivotal skill to create any sense of shared conversation or interaction. Bottema-Beutel (2016) conducted a meta-analysis confirming the importance of joint attention skills and language outcomes. Research indicated that the ability to respond to a partner's input is heavily linked with language outcomes

in children with ASD. Additionally, children with ASD exhibit difficulty with the use of nonverbal communicative behaviors that are pivotal to joint attention development, such as less frequent use of eye contact, pointing, and gestures. (McEnvoy, Rogers, & Pennington, 1993).

Theories of Language

Different language theories explain the development of language from various perspectives. The following theories on language development that are commonly discussed in the context of speech and language interventions: 1) Social Learning Theory, 2) Behaviorism, or Operant Learning Theory (Skinner, 1957), 3) nativist, and 4) social interactionist theory. The Operant Learning Theory of language focuses on the function of communicative acts and was, therefore, the focus of this study and will be highlighted below.

According to B.F. Skinner, the verbal behavior approach is based on teaching the function and application of words within the environment on top of providing reinforcement (Skinner, 1957). This approach, also known as Operant Learning Theory, suggests that without input from the environment (via parents, peers, etc.) language does not develop. This view suggests that language is a "behavior" and therefore controlled by antecedents and reinforcement. Skinner differentiated between different "verbal operants" or communicative functions. Verbal operants are considered to be the unit of analysis in a functional relationship between a certain type of responding and the same independent variables that control nonverbal behavior. This implies the communicative function to be a type or class of behavior as separate from a particular response instance (Skinner, 1957; Sundberg & Michael, 2001). He described these functions for the speaker as (1) echoics, (2) mands, (3) tacts, (4) autoclitics, (5)

intraverbals, and (6) textual responding. For this study, the focus is on five verbal operants which are defined in Table 2. These five operants include mand, tact, intraverbal, listener, and echoic.

Table 2. Skinner's Verbal Operants

Operant	*Explanation*
Mand	Requesting or asking for something that you want. (e.g., the child says juice or points to a glass of join to indicate they want it) Mands can also occur if the person wants an undesirable stimulus to be removed (e.g., stop it, pushing materials away).
Tact	Naming or identifying objects, actions, events, etc. (e.g., the child says dog because they see an actual dog, pointing to the dog without receiving reinforcer)
Intraverbal	Answering questions or having a conversation where your words are controlled by another person's words (e.g., a child is asked what they want and they respond "bottle" or pointing to a bottle in response to the same question)
Listener	Following instructions or complying with the mands of others (e.g., a child picks up toys when the teacher says "playtime is over, it's time to clean up")
Echoic	Repeating exactly what is heard (e.g., saying "ball" after someone else says "ball")

Skinner (1957) considers all verbal operants to be initially independent in regard to function during language development. Therefore, a child may be able to request/mand for an item but not be able to label/tact the item. This supports the idea of targeting each communicative function independently. Several studies have upheld this viewpoint in that developmentally delayed individuals have difficulty with the ability to establish these communicative functions without direct instruction. In addition to the verbal operants, Skinner (1957) distinguished the importance of manding in a child's verbal repertoire. Out of all the operants listed, mands deliver a specific reinforcement that the speaker requested. Whereas, the

other verbal operants (i.e., echoic, tact, listener, and intraverbal) provide a more generalized reinforcement of social attention or approval (Sundberg & Michael, 2001).

Predictors of Language Outcomes in Children with ASD

Verbal language outcome in children with ASD has been studied measuring different types of behavior forms (e.g., joint attention, early receptive skills, phonemic inventory, motor imitation), treatment profiles (i.e., hours in treatment), and environmental factors (i.e., parent responses). Yoder and Watson (2014) conducted a study of predictors and conducted an extensive literature search. In the longitudinal study, nine putative predictors of language growth in preschoolers with ASD who were minimally verbal were investigated (with permission by Yoder, see Table 1). The participants included 87 children (71 male and 16 female) who were between 24 and 48 months of age. Children that were excluded from the study included severe sensory or motor impairments, metabolic or progressive neurological disorders, and identified genetic syndromes. The participants had a clinical diagnosis of ASD, reported to say no more than 20 different words, and produced no more than five different word roots during a 15-minute language sample. Nine putative predictors of expressive language growth (see Table 1), seven putative predictors of receptive vocabulary development, and two background variables (i.e., cognitive level and autism symptomology) were measured in five measurement points. The use of parent questionnaires, standardized assessments, and behavior sampling were analyzed. Results from the study established that responding to joint attention, intentional communication, and parent linguistic responses were value-added predictors of expressive and receptive spoken language growth. In addition, consonant inventory was a predictor of expressive growth and early receptive vocabulary and autism severity were predictors of receptive growth. It was also suggested that object play, attention during child-directed speech, motor imitation, and

nonimitative oral motor functioning did not provide value-added predictors for language growth in both receptive and expressive.

Table 1. Putative predictors of language and their empirical and theoretical support

Putative predictor	**Example studies finding associations with language in children with ASD**	**Theories justifying the selection of predictor**
Attention during child-directed speech	Campbell et al. (2014), Paul et al. (2007), Watson et al. (2010)	Cognitive, social, transactional
Responding to others' bid for joint attention	Paul et al. (2008), Siller and Sigman (2008), Thurm et al. (2007), Wetherby et al. (2007)	Cognitive, social, transactional
Early receptive language	Luyster et al. (2007), Paul et al. (2008), Thurm et al. (2007)	Cognitive
Intentional communication	Charman et al. (2005), Plumb and Wetherby (2013), Yoder (2006)	Cognitive, social
Motor imitation	Gernsbacher et al. (2008), Poon et al. (2012), Stone and Yoder (2001), Thurm et al. (2007), Toth et al. (2006)	Motor, cognitive, social
Parent linguistic responses to child leads	Haebig et al. (2013), McDuffie and Yoder (2010), Perryman et al. (2013), Siller and Sigman (2002, 2008)	Transactional
Nonimitative oral motor functioning	Amato and Slavin (1998), Belmonte et al. (2013), Gernsbacher et al. (2008)	Motor
Early consonant inventory	Paul et al. (2008), Wetherby et al. (2007)	Social, motor
Object play	Poon et al. (2012), Toth et al. (2006), Wetherby et al. (2007), Yoder (2006)	Cognitive, social, motor

Mayo et al. (2013) studied if the age of first words predicted 4.5-year-olds' outcomes and whether there was a certain age of onset for first words that differentiated children with improved outcomes. They found that the 24-month age benchmark of first words distinguished those with better outcomes in regards to higher cognitive ability and adaptive skills. Also, children who have not spoken their first words by 24-months could be at risk for later functional deficits, although since the first-word acquisition is a continuous variable, it may be skewed (Rucker, McShane, & Preacher, 2015). This salient marker indicates a powerful prognostic tool for professionals and parents to use and enhance the widely accepted criteria that useful language needs to be acquired by age 5. Specifically, improved outcomes were exhibited in the domains of communication, daily living, social and motor functioning. As a result, early identification and early diagnosis are clinically beneficial to promote language acquisition. Sandbank et al. (2017) assessed five value-added predictors of intentional communication and determined that early motor imitation was the only predictor that contributed to the variance in children's later intentional communication. Thus far, the age at first words acquisition, phrased speech, parent responsiveness, and joint attention was found to predict developmental trajectories of functional behavior and language milestones in several studies (Ellis Weismer, 2000; Paul, 2000). The importance of identifying relationships between different behaviors and communicative outcomes helps clinicians to develop functional goals that will facilitate spoken language earlier (Yoder, Watson, & Lambert, 2015). Therefore, it is crucial to not only investigate the relationship between language forms, environmental variables, play behaviors to communicative outcomes, but also the function of communicative acts.

Some relationships between different types of communication functions have been studied in the context of the verbal behavior theory of language. Regarding verbal behavior,

specific tact instruction research has been conducted to understand the production of spontaneous speech in children with ASD. The child's ability to tact is their capability to label and name objects, actions, or events. Partington et al. (1994) suggested that the reason for the failure to acquire the ability to tact/label could be related to the antecedent (i.e., the antecedent is the stimulus that is presented to the child before they tact). For example, the antecedent "What is that?" may hinder the establishment of stimulus control by a nonverbal stimulus. Stimulus control in terms of verbal behavior occurs when the child reacts in one way in the presence of a given stimulus and another way in its absence. Therefore, the use of "What is that?" is a verbal stimulus given to the child to elicit a response, in this case, a label/tact response. Research suggests that use of this stimulus affects nonverbal stimulus (i.e., spontaneous speech) in eliciting a tact response from a child. The importance of developing tact has implications on verbal output growth and a key component to developing other speaker and listener capabilities including naming, observational learning of tacts, textual responding, and intraverbal responses (Greer & Ross, 2006).

Intensive tact training has been found to increase the emission of verbal operants and spontaneous speech which requires students to learn an additional 100 tacts (label/naming) each day by using learn units (Pistoljevic and Greer, 2006). A learn unit is a comprehensive measurement of teaching. Pereira Delgado and Oblak (2007) replicated this study and confirmed findings that there is a functional relationship demonstrated between the intensive tact protocol that showed increases in independent verbal operants in non- instructional settings. These settings included recess, lunch, play, and in the hallway on children who elicited few "pure tacts" which are tacts that result from a physical stimulus and not verbal stimulus control, like "What is

that?", therefore occurring under a natural motivational condition. For example, an example of a pure tact would be the student during lunch and emitting the tact "sandwich".

Assessing Language in Children with ASD from a Verbal Behavior Perspective

Standardized language assessments are important to compare a child's language skills to those of a typical group of peers. Language assessments aid in identifying a proper diagnosis in the case of language deficits. Additionally, assessments lead to an appropriate treatment regimen. Once the individual qualifies for treatment, baseline data on different language skills can be obtained and appropriate treatment plans are developed. For children with ASD, speech-language pathologists will generally assess social and communication skills in children with ASD. It is difficult to accurately determine language skills in children with ASD due to a lack of attention or motivation to complete certain tasks. Therefore, professionals often rely on parental reports supplemented with standardized tests and naturalistic observations through language samples. Unfortunately, parental information may not always be an accurate representation of the child's typical skills (Goldstein, Naglieri, & Ozonoff, 2009; Kasari, Brady, Lord, & Tager-Flusberg, 2013). Even though, Jyothishi, Fein, and Naigles (2017) documented that parent reports on the Vineland Adaptive Behavior Scales mostly agree with clinician-observed child language skills in preschool children with ASD (Jyotishi, Fein, & Naigles, 2017).

Most assessments that are used by speech-language pathologists evaluate the response form alone (ex. phonology, morphology, and syntax) without regard for functional communication. An assessment of speech and language without both form and function will deliver an incomplete treatment program that fails to assess controlling variables that may enhance or weaken responses. Assessments that lack all areas of language will lack the

functional analysis of verbal behavior that is required to initiate behavior change. The importance of speech and language functions include the form, semantics, and pragmatics (Esch, 2010). It is important for the field of speech-language pathology to view language learning not only from a form perspective but also from a functional lens.

This current study focused on obtaining data from a common assessment tool used by Board Certified Behavior Analysts (BCBA). This tool is the *Verbal Behavioral Milestones Assessment and Placement Program* (VB-MAPP, Sundberg, 2008) and it assesses the development of verbal milestones over time in children with ASD. The VB-MAPP is a criterion-referenced assessment that measures an individual's mastery of skills of a specific verbal operant (see Table 2, Sundberg, 2014). The VB-MAPP contains a Milestones Assessment, Barriers Assessment, as well as a Transition Assessment.

For this study, the Milestones portion of the test was utilized. The Milestones Assessment contains 16 individual measures of language and the majority of the measures include Skinner's verbal operants (i.e., echoic, mand, tact, intraverbal) as well as additions like MLU, vocabulary size, syntax and grammatical conventions, listener skills, visual perception skills, vocal output, play, and socialization skills. The 16 domains are divided into a developmental sequence with three levels. The first level includes nine measures that align with learning and language skills exhibited by a typically developing child between 0 and 18 months. The next level consists of 12 measures that have skills exhibited by a typically developing child between 18 and 30 months of age. The final level contains 13 measures that are intended for typically developing children between 30 and 48 months. This study focused on investigating changes of milestones for mand, tact, echoic, and intraverbal sections over time. Refer to Table 2 for explanations of these specific operants.

Research Questions

The purpose of this study was to investigate milestones at two points in time to understand the relationship between the development of verbal operants or communicative functions in children with ASD. The following research question was guiding the investigation:

1) What is the relationship between verbal operants (i.e., mand, tact, listener, echoic, and intraverbal) development over time (i.e. Time 1 to Time 2) in children with ASD as measured by the VB-MAPP?

We hypothesized that the specific verbal operants (i.e., mand, tact, echoic, and intraverbal) would show a positive relationship to the development of verbal operants. However, based on previous studies, we also anticipated that intraverbals would not show this relationship.

CHAPTER 2.
METHODS

Participants

The data was obtained through chart review from The Emerge Center, in Baton Rouge, Louisiana. The Emerge Center provides services for populations like ASD and other individuals with communication challenges. The children that were eligible for the study include children with an ASD diagnosis, between the ages of 2 years, 0 months and 6 years, 11 months. Children that were excluded from the study if they did not have a diagnosis of ASD, had an uncorrected hearing or visual impairments, and/or if they fell outside the age limit. Participants were both verbal and nonverbal.

We obtained longitudinal data from pre-existing assessments of the VB-MAPP from 15 children with ASD. After parents signed informed consent, the data was obtained through a chart-review and then entered into an excel sheet by formatting each participant at two different testing time points (i.e., Time 1 and Time 2). Each participant's data came from pre-existing data from the VB-MAPP. The VB-MAPP was conducted by trained Board Certified Behavior Analysts (BCBA). All BCBA's at the Emerge Center are trained to in-house reliability. There were a total of 15 participants in this study, 5 females and 10 males. The participants ranged in age at Time 1 from 23 to 62 months of age, with a mean of 40.67 months and a standard deviation of 11.66. At Time 2, the participant's age ranged from 28-70 months of age, with a mean of 48.73 and a standard deviation of 11.708. The average time in months between Time 1 and Time 2 ranged from 5 to 17 months, with a mean of 8.07 months and a standard deviation of 4.217.

Table 3. Participant Demographics

Participants (N=15)	
Gender	
Male	*n* = 10
Female	*n* = 5
Age in Months at T1 (mean, range, SD)	40.67 (23-62) SD 11.66
Age in Months at T2 (mean, range, SD)	48.73 (28-70) SD 11.708
Time in Months between T1 and T2 (mean, range, SD)	8.07 (5-17) SD 4.217

Instrumentation

This study examined different verbal operants of mand, tact, echoic, and intraverbal milestones in the VB-MAPP. As previously stated, the VB-MAPP was designed as a behavioral approach to assessing children with autism's language skills formed upon on B.F. Skinner's language analysis of verbal behavior and verbal operants. This assessment is a common tool for BCBA's use in Early Intensive Behavioral Interventions (EIBI). This criterion-referenced assessment provides professionals a comprehensive view of the child's strengths and weaknesses in a developmental view and also provides barriers to skill acquisition, like language.

The *Milestones Assessment* of the VB-MAPP is used to evaluate and track progress over time. This study concentrated on four of the nine operants (i.e., mand, tact, echoic, and intraverbal). At The Emerge Center, the VB-MAPP is administered approximately every six months. The relationship between the development of different verbal operants was examined by collecting VB-MAPP data from two different points.

Procedure

Administration of the VB-MAPP was conducted at the Emerge Center during the participant's usual hours of therapy at the center. The assessments were administered by BCBA's who were highly educated and trained on the process of administering the assessment. The

majority of the testing sessions occurred in individual rooms that provided a quiet environment for testing. The VB-MAPP was administered on average every 8 months (range of 5 months to 17 months) for each participant to determine the child's progress and update their intervention plan accordingly. The Institutional Review Board (IRB) approved the study. After parents signed informed consent, data was obtained from Emerge by a graduate student in the Communication Sciences and Disorders (COMD). Identifying information was removed from protocols for data analysis by assigning a code to each participant. Each participant had VB-MAPP scores from at least two time points. If a participant had more than two VB-MAPP scores, the last two scores were used for analysis.

The graduate student who obtained the data entered the data into a spreadsheet for analysis. Intra-rater reliability (IRR) was conducted by the graduate student who double-checked and fixed discrepancies within the excel sheet.

Data Analysis

Regarding the relationship between communicative functions or verbal operants, a Pearson's correlation was conducted using difference scores for each verbal operant. Difference scores were obtained for each operant by subtracting raw scores from Time 1 (T1) from raw scores from Time 2 (T2). A total raw score of 15 was possible for manding, tacting and listener responding, while a raw score of 10 was possible for echoic and intraverbal. The mean for the difference scores was then calculated for all 15 participants. The difference score indicated the amount of growth that occurred for the verbal operant from T1 to T2. For example, if a participant had a raw score of 3 for Mand at T1 and a score of 5 at T2, the difference score would be 2. SPSS Version 25 was used to calculate Pearson's correlation.

CHAPTER 3.
RESULTS

In order to assess the relationship and growth between the selected communicative functions (i.e., mand, tact, listener, echoic, and intraverbal) from T1 to T2, a Pearson Correlation was performed using the difference in mean raw scores from the VB-MAPP of each operant. The Pearson Correlation put into relation the average difference scores from 15 participants for each mand, tact, listener, echoic, and listener. The correlation found that the participant's growth in the ability to mand was associated with their growth in tacting (r = .742, $p < .002$), listener/repetitive skills growth (r = .679, $p < .005$), and echoic/verbal imitation growth (r =.540, $p < .038$). However, no significant correlation was found between the growth in manding and growth in intraverbal skills (r =.343, p =.211). The correlations between the participants growth in the ability to tact, receptive/listener growth, echoic, and intraverbal were all found to be statistically significant (see Table 4). The only non-significant finding was between the growth in manding and intraverbal skills.

Table 4. Correlations Between Difference Raw Scores of Verbal Operants in the VB-MAPP

		Difference Mand	Difference Tact	Difference Listener	Difference Echoic	Difference Intraverbal
Difference Mand	Pearson Correlation	1	.742 **	.649 **	.540 *	.343
	Significance (2-tailed)		.002	.005	.0038	.211
Difference Tact	Pearson Correlation	7.42 **	1	.728 **	.667 **	.566 *
	Significance (2-tailed)	.002		.002	.007	.028
Difference Listener	Pearson Correlation	.679 **	.728 **	1	.861 **	.824 **
	Significance (2-tailed)	.005	.002		.000	.000

(Table cont.)

		Difference Mand	Difference Tact	Difference Listener	Difference Echoic	Difference Intraverbal
Difference Echoic	Pearson Correlation	.540 *	.667 **	.861 **	1	.699 **
	Significance (2-tailed)	.038	.007	.000		.004
Difference Intraverbal	Pearson Correlation	.343	.566*	.824**	.699**	1
	Significance (2-tailed)	.211	.028	.000	.004	

** Correlation is significant at the .01 level (2-tailed)

*Correlation is significant at the .05 level (2-tailed)

CHAPTER 4.
DISCUSSION

The purpose of the current study was to investigate the relationship in the change of communicative functions (i.e., verbal operants) from the VB-MAPP (i.e., mand, tact, listener, echoic, and intraverbal) in children with ASD. The VB-MAPP is a tool that is primarily utilized by the Applied Behavior Analysis (ABA) community by BCBAs. This study sought to investigate whether the growth in certain communicative functions is correlated with growth in other communicative functions. In addition, the study advocates the use of VB-MAPP in a cross-disciplinary approach in order to develop goals, treatment plans, and track progress in the treatment of children with ASD. The following research question directed the study: What is the relationship between the development of verbal operants (i.e., mand, tact, listener, echoic, and intraverbal) development over time (i.e. Time 1 to Time 2) in children with ASD as measured by the VB-MAPP?

Mand, tact, listener, echoic and intraverbal were the focus of this investigation. The majority of a typically developing child's early language consists of mands; therefore, it is important to measure the acquisition and development of this skill over time to aid in providing more predictors for prognostic information (Sundberg & Michael, 2001). The ability to tact can lead to understanding the child's intraverbal behavior thus it is important to determine whether tacting affects intraverbal and verbal development. Individuals with ASD have the greatest difficulty with intraverbal behavior skills. This involves explaining, discussing, or demonstrating an item or situation that is not currently in view or currently happening. Without the ability to request for an item (i.e., mand) or name an item to request (i.e., tact), a child's intraverbal skills will most likely be limited. In regards to the echoic verbal operant, the information of the quality and strength in the child's ability to imitate can provide possible obstacles in producing

responses that are fundamental for verbal interactions (Sundberg & Michael, 2001). Therefore, if the child cannot imitate specific sounds, the possibility of those responses occurring in other functional communicative acts is significantly lower. This emphasizes the purpose of this study to find specific milestones, or verbal operants, that predict verbal development.

Research Question

The study investigated five variables from the VB-MAPP milestones assessment and compared the difference score with each verbal operant in order to determine a relationship between the progress from T1 to T2. The correlations that were found to be significant were the development of the skill to mand with the development of skills in tacting, listener/receptive, and echoic/verbal imitation. Nonetheless, there was no correlation found between the participants' development in manding and their increase in intraverbal skills. This lack of relationship suggests that a child's increase in knowing how to mand, or request via verbal, gesture or a picture exchange communication system, does not necessarily show an increase in skills in intraverbal capabilities, which is to answer questions. For example, the child may be able to request an apple either by saying the word, gesturing or pointing to the apple or handing someone a picture in exchange for the apple. However, being able to request the apple, does not necessarily mean that the child can answer a question for which the answer would be 'apple', such as "What fruit grows on a tree?" In addition, a words that refers to different item functions has so a child may not have the ability to answer a question about an item, just because he/she was able to request the item. For example, the child may be able to label the number "four" but have difficulty filling in the sentence for "1, 2, 3…___." Intraverbal skills are considered to be a higher-level communicative function that take more time for acquisition (Sundberg & Sundberg, 2011). The growth in manding shows a significant relationship of the development of the other

three communicative functions of tact, listener, and echoic. This means, if a child can request 'apple', development of the ability to label 'apple', repeat the word 'apple' as well as follow directions (e.g., 'Hand me the apple, please!') is closely related. To clarify, just because a child can mand for an apple, does not mean he/she can automatically tact, respond appropriately or echo the word, but these skills are related in children with ASD.

Interpretations

Interestingly, there was a significant correlation between tact, listener responding, echoic and intraverbal. Therefore, if a child learned how to tact, the ability to answer questions will follow a developmental pattern that is related to changes in tacting abilities. The relationship of the development of listener responding (receptive skills) of following instructions or complying with the mands is strongly correlated with the four other functions of mand, tact, echoic, and intraverbal. This indicates that a child's ability to follow directions is related to their growth in expressive language domains of requesting, labeling, verbal imitation, and higher-level intraverbal skills. Expressive language does not necessarily have to be verbal as measured by the VB-MAPP. Expressive language can also mean gestures, signs or picture communication. As such, the development of echoic, or verbal imitation was found to have a statistically significant relationship within the following four operants (mand, tact, listener, and intraverbal). This finding indicates that a child's capacity to imitate verbally is directly related to their development of the four other functions.

The findings of the current study suggest that the relationship of the development of the communicative functions selected from the VB-MAPP suggests several correlations in regard to an increase in each domain, aside from mand and intraverbal. Intraverbal skills represent the social communication domain where a child is able to answer questions or hold a conversation.

Along with the diagnostic criteria for ASD, social communication impairments include the inability of reciprocity/initiation of social or emotional interaction, severe difficulties maintaining and developing relationships, and nonverbal communication problems (American Psychiatric Association, 2013). It is imperative to a person's language ability to converse and respond to questions. Therefore, results from this study indicate that a child's ability to mand is not necessarily indicative of their ability to answer a question, even if they have the linguistic form (e.g., apple). Several intensive behavioral interventions, like the Picture Exchange Communication System (PECS), focus on increasing verbal output by teaching how to request (mand) (Chaabane, Morgan, and DeBar, 2009). Unfortunately, at times, expanding communicative functions does not appear to be a priority in treating children with ASD. The core deficit of social communication and interaction may therefore never be addressed.

Clinical Implications

The results from the study were gathered from a small sample of 15 children with ASD from one facility, but the relationship and correlations that were established should guide clinical practice of professionals who work with children with ASD. For example, teaching a child to mand (request) is critical because manding is how children can convey their wants and needs. However, in some intensive programs, should not only be in utilizing their voice to mand. Clinical professionals should teach all components of language and not just the ability to request. As shown in the results, the participants' growth in manding did not show a relationship with intraverbal skills suggesting that teaching only manding might limit operants like intraverbal skills. As stated previously, learning to respond to the verbal behavior of someone, via intraverbals, is extremely important in guiding intentional social interactions and holding a

conversation (Skinner, 1957). Primarily, the current study provides these important clinical implications:

1) Clinicians would benefit from utilizing a multi-modal language approach to increase all components of language in children with ASD. Professionals should move away from solely focusing on the child's request. Using a certain language form for requesting may not generalize to using the same form in response to a question (intraverbal).
2) Increase collaboration between behavior analysis and SLPs and increase verbal behavior repertoire such as the specific verbal operants (mand, tact, echoic, intraverbal).

Limitations

There were several limitations to this study. First, the small sample size (N = 15), was a limitation. Also, the sample was collected from one facility and a sample that was gathered from different locations would lower the chance of uncoverage bias. Another limitation is the variability of time points between the participants tested at T1 and T2. Out of the 15 participants, three had over 14 months between testing compared to the majority (12) had between 5-7 months between testing. The average range of testing between T1 and T2 for the 15 participants was M = 8.07 months (SD = 4.217). A more homogenous sample, either with a narrower age group or narrower inclusion criteria might yield different results. Although the study aimed to include participants whose VB-MAPP's had been administered within six months of testing between T1 and T2, there were 3 outliers. Language skills can progress significantly in this time.

Future Directions

The study of the relationship between communicative function development can take a variety of future directions. The current study could be improved by increasing the sample size, increasing the number of time points, and reducing the average months between each time point to increase the statistical strength of the results. Further, it would be interesting to record the actual development of verbal language to determine the outcome of verbal development over time regarding these specific communicative functions. This could be completed by collecting a language sample or providing the MacArthur Communicative Development Inventories (CDIs). The VB-MAPP also provides a Barriers Assessment that quantifies different barriers to learning. Utilizing the Barriers Assessment to determine if there is a relationship between growth and specific barriers could provide further information on prognostic features of a child with ASD as well as provide valuable information to determine different barriers to learning verbal development over time.

Conclusion

In conclusion, the current study found that some of the communicative functions/verbal operants (i.e., mand, tact, echoic, listener, and intraverbal) assessed in the VB-MAPP all correlated in regard to their development in children with ASD. We hypothesized that the specific verbal operants (i.e., mand, tact, echoic, and intraverbal) would be positively related to the development of verbal operants. However, we also anticipated that intraverbals would less correlated. In support of our hypothesis, there was a significant positive relationship between the development of the verbal operants. Surprisingly, intraverbals developed along the same timeline as did the children's tact, echoic, and listener skills – though not their mand skills. Due to the

limitations of this study, further ASD research is needed to grow our understanding of relations between children's development of various communicative functions at various points of time and across time.

REFERENCES

American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed. Arlington, VA: American Psychiatric Association; 2013.

Arunachalam, S., & Luyster, R. J. (2016). The integrity of lexical acquisition mechanisms in autism spectrum disorders: A research review. Autism Research, 9, 810–828. https://doi.org/10.1002/aur.1590

Baio, J. (2012). Prevalence of Autism Spectrum Disorders: Autism and Developmental Disabilities Monitoring Network, 14 Sites, United States, 2008. Morbidity and Mortality Weekly Report. Surveillance Summaries. Volume 61, Number 3. Centers for Disease Control and Prevention.

Baio, J., Wiggins, L., Christensen, D. L., Maenner, M. J., Daniels, J., Warren, Z., ... & Durkin, M. S. (2018). Prevalence of autism spectrum disorder among children aged 8 years—autism and developmental disabilities monitoring network, 11 sites, United States, 2014. *MMWR Surveillance Summaries*, *67*(6), 1.

Bopp, K. D., Mirenda, P., & Zumbo, B. D. (2009). Behavior predictors of language development over 2 years in children with autism spectrum disorders. Journal of Speech, Language, and Hearing Research, 52, 1106–1120.

Bottema-Beutel, K. (2016). Associations between joint attention and language in autism spectrum disorder and typical development: A systematic review and meta-regression analysis. Autism Research, 9, 1021–1035. https://doi.org/10.1002/aur.1624

Bruinsma, Y., Koegel, R. L., & Koegel, L. K. (2004). Joint attention and children with autism: A review of the literature. *Mental retardation and developmental disabilities research reviews*, *10*(3), 169-175.

Carr, J. E., & Firth, A. M. (2005). The verbal behavior approach to early and intensive behavioral intervention for autism: A call for additional empirical support. Journal of Early and Intensive Behavior Intervention, 2, 18– 27.

Chaabane, D. B. B., Alber-Morgan, S. R., & DeBar, R. M. (2009). The effects of parent-implemented PECS training on the improvisation of mands by children with autism. *Journal of Applied Behavior Analysis*, *42*(3), 671-677.

Charman, T., Taylor, E., Drew, A., Cockerill, H., Brown, J. A., & Baird, G. (2005). Outcome at 7 years of children diagnosed with autism at age 2: Predictive validity of assessments conducted at 2 and 3 years of age and pattern of symptom change over time. Journal of Child Psychology and Psychiatry and Allied Disciplines, 46(5), 500–513.

Chawarska, K., Paul, R., Klin, A., Hannigen, S., Dichtel, L. E., & Volkmar, F. (2007). Parental recognition of developmental problems in toddlers with autism spectrum disorders. Journal of Autism and Developmental Disorders, 37(1), 62–72. doi:10. 1007/s10803-006-0330-8.

Cohen, I. L., Sudhalter, V., Landon-Jimenez, D., & Keogh, M. (1993). A neural network approach to the classification of autism. Journal of Autism and Developmental Disorders, 23, 443–466.

Coonrod, E. E., & Stone, W. L. (2004). Early concerns of parents of children with autistic and nonautistic disorders. Infants and Young Children, 17(3), 258–268.

Dawson, G., Toth, K., Abbott, R., Osterling, J., Munson, J., Estes, A., & Liaw, J. (2004). Early social attention impairments in autism: social orienting, joint attention, and attention to distress. *Developmental psychology*, *40*(2), 271.

Ellis Weismer, S., & Kover, S. T. (2015). Preschool language variation, growth, and predictors in children on the autism spectrum. Journal of child psychology and psychiatry, and allied disciplines, 56(12), 1327–1337. doi:10.1111/jcpp.12406

Ellis Weismer, S. (2000). Intervention for children with developmental language delay. In D. V. M. Bishop & L. B. Leonard (Eds.), Speech and language impairments in children: Causes, characteristics, intervention, and outcome (pp. 157–176). Hove, UK: Psychology Press

Esch, B. E., LaLonde, K. B., & Esch, J. W. (2010). Speech and language assessment: A verbal behavior analysis. *The Journal of Speech and Language Pathology–Applied Behavior Analysis*, *5*(2), 166.

Fernald, A. (1992). Human maternal vocalizations to infants as biologically relevant signals: An evolutionary perspective. In J. H. Barkow & L. Cosmides (Eds.), Adapted mind: Evolutionary psychology and the generation of culture (pp. 391–428). London: Oxford University Press.

Gillespie-Lynch, K., Sepeta, L., Wang, Y., Marshall, S., Gomez, L., Sigman, M., et al. (2012). Early childhood predictors of the social competence of adults with autism. Journal of Autism and Developmental Disorders, 42(2), 161–174.

Goldstein, S., Naglieri, J. A., & Ozonoff, S. (2009). Assessment of autism spectrum disorders (pp. xiv, 384). *New York: Guilford*.

Greer, R. D., Ross, D. E. (2006). Verbal Behavior Analysis: Inducing and Expanding New Verbal Capabilities in Children with Language Delays. New York, NY: Allyn and Bacon

Bahadourian, A. J., Tam, K. Y. B., Greer, R. D., & Rousseau, M. K. (2006). The effects of learn units on student performance in two college courses. *International Journal of Behavioral Consultation and Therapy*, *2*(2), 246.

Herlihy, L., Knoch, K., Vibert, B., & Fein, D. (2013). Parents' first concerns about toddlers with autism spectrum disorder: Effect of sibling status. Autism, 19, 20–28. doi:10.1177/1362361313509731.

Hill, E. L. (2004). Executive dysfunction in autism. *Trends in cognitive sciences*, *8*(1), 26-32.

Howlin, P., Goode, S., Hutton, J., & Rutter, M. (2004). Adult outcome for children with autism. Journal of Child Psychology and Psychiatry, 2, 212–229. doi:10.1111/j.1469-7610.2004.00215.x.

Jyotishi, M., Fein, D. A., & Naigles, L. R. (2017). "Didn't I just say that?" Comparing parent report and spontaneous speech as indicators of grammatical development. Research in developmental disabilities, 61, 32–43. doi:10.1016/j.ridd.2016.12.013

Kaderavek, J. N. (2011). *Language disorders in children: Fundamental concepts of assessment and intervention*. Pearson/Prentice.

Kasari, C., Brady, N., Lord, C., & Tager‐Flusberg, H. (2013). Assessing the minimally verbal school‐aged child with autism spectrum disorder. *Autism Research*, *6*(6), 479-493.

Kenworthy, L., Wallace, G. L., Powell, K., Anselmo, C., Martin, A., & Black, D. O. (2012). Early language milestones predict later language, but not autism symptoms in higher functioning children with autism spectrum disorders. Research in Autism Spectrum Disorders, 6(3), 1194–1202. doi:10.1016/j.rasd.2012. 03.009.

Kjelgaard, M. M., & Tager-Flusberg, H. (2001). An investigation of language impairment in autism: Implications for genetic subgroups. *Language and cognitive processes*, *16*(2-3), 287-308.

Kurita, H. (1985). Infantile autism with speech loss before the age of thirty months. *Journal of the American Academy of Child Psychiatry*, *24*(2), 191-196.

Kwok, E. Y., Brown, H. M., Smyth, R. E., & Cardy, J. O. (2015). Meta-analysis of receptive and expressive language skills in autism spectrum disorder. *Research in Autism Spectrum Disorders*, *9*, 202-222.

Landry, S. H., Smith, K. E., & Swank, P. R. (2006). Responsive parenting: Establishing early foundations for social, communication, and independent problem-solving skills. Developmental Psychology, 42, 627–642.

Le Couteur, A., Bailey, A., Rutter, M., & Gottesman, I. (1989). Epidemiologically based twin study of autism. Paper presented at the First World Congress on Psychiatric Genetics, Churchill College, Cambridge, England.

Lord, C., Risi, S., & Pickles, A. (2004). Trajectory of language development in autistic spectrum disorders. In M. Rice & S. Warren (Eds.), Developmental language disorders: From phenotypes to etiologies (pp. 7–29). Mahwah, NJ: Lawrence Erlbaum Associates

Lord, C., Wagner, A., Rogers, S., Szatmari, P., Aman, M., Charman, T., et al. (2005). Challenges in evaluating psychosocial interventions for autistic spectrum disorders. Journal of Autism and Developmental Disorders, 35(6), 695–708.

Lord, C. & Paul, R. (1997). Language and communication in autism. In D. J. Cohen & F. R. Volkmar (Eds.), Handbook of autism and pervasive development disorders, 2nd edition. New York: John Wiley.

Luyster, R. J., Seery, A., Talbott, M. R., & Tager-Flusberg, H. (2011). Identifying early-risk markers and developmental trajectories for language impairment in neurodevelopmental disorders. Developmental Disabilities Research Reviews, 17(2), 151–159. doi:10. 1002/ddrr.1109.

Mayo, J., Chlebowski, C., Fein, D. A., & Eigsti, I.-M. (2013). Age of first words predicts cognitive ability and adaptive skills in children with ASD. Journal of Autism and Developmental Disorders, 43(2), 253–264. doi:10.1007/s10803-012-1558-0.

McEvoy, R. E., Rogers, S. J., & Pennington, B. F. (1993). Executive function and social communication deficits in young autistic children. Journal of Child Psychology and Psychiatry, 34(4), 563–578. doi:10.1111/j.1469-7610.1993.tb01036.x

Mundy, P., Sigman, M., & Kasari, C. (1990). A longitudinal study of joint attention and language development in autistic children. Journal of Autism and Developmental Disorders, 20, 115–128.

Osterling, J., & Dawson, G. (1994). Early recognition of children with autism: A study of first birthday home videotapes. *Journal of autism and developmental disorders*, *24*(3), 247-257.

Partington, J. W., Sundberg, M. L., Newhouse, L., & Spengler, S. M. (1994). Overcoming an autistic child's failure to acquire a tact repertoire. Journal of Applied Behavior Analysis, 27, 733–734.

Paul, R. (2000). Predicting outcomes of early expressive language delay: Ethical implications. In D. V. M. Bishop & L. B. Leonard (Eds.), Speech and language impairments in children: Causes, characteristics, intervention, and outcome (pp. 195–209). Hove, UK: Psychology Press

Paul, R. (2008). Interventions to improve communication in autism. Child and Adolescent Psychiatric Clinics of North America, 17(4), 835–856.

Pickles, A., Anderson, D. K., & Lord, C. (2014). Heterogeneity and plasticity in the development of language: A 17-year follow-up of children referred early for possible autism. Journal of Child Psychology and Psychiatry, 55, 1354–1362. https://doi.org/10.1111/jcpp.12269

Rucker, D. D., McShane, B. B., & Preacher, K. J. (2015). A researcher's guide to regression, discretization, and median splits of continuous variables. Journal of Consumer Psychology, 25, 1–13. doi:10.1016/j.jcps.2015.04.004.

Sandbank, Micheal, et al. (2017). "Predicting intentional communication in preverbal preschoolers with autism spectrum disorder." *Journal of autism and developmental disorders* 47.6 (2017): 1581-1594.

Sautter, R. A., & LeBlanc, L. A. (2006). The empirical applications of Skinner's analysis of verbal behavior with humans. The Analysis of Verbal Behavior, 22, 35–48.

Shumway, S., & Wetherby, A. M. (2009). Communicative acts of children with autism spectrum disorders in the second year of life. Journal of Speech, Language, and Hearing Research, 52(5), 1139–1156.

Sigman, M., & Ruskin, E. (1999). Continuity and change in the social competence of children with autism, Down syndrome, and Developmental delays Monographs of the Society for Research in Child Development, 64.

Skinner, B. F. (1957). Verbal behavior. New York: Appleton-Century-Crofts.

Smith, V., Mirenda, P., & Zaidman-Zait, A. (2007). Predictors of expressive vocabulary growth in children with autism. *Journal of Speech, Language, and Hearing Research*.

Spiker, D., Boyce, G., & Boyce, L. (2002). Parent-child interactions when young children have disabilities. International Review of Research in Mental Retardation, 25, 35–70.

Stone, W. L., & Yoder, P. J. (2001). Predicting spoken language level in children with autism spectrum disorders. *Autism*, *5*(4), 341-361.

Stone, W. L., Coonrod, E. E., & Ousley, O. Y. (2000). Brief report: Screening tool for autism in two-year-olds (STAT): Development and preliminary data. Journal of Autism and Developmental Disorders, 30(6), 607–612

Sundberg, M. L. (2014). The VB-MAPP : Conducting the Assessment and Identifying Intervention Priorities [PowerPoint slides], 1–28.

Sundberg, M. L., & Sundberg, C. A. (2011). Intraverbal behavior and verbal conditional discriminations in typically developing children and children with autism. *The Analysis of verbal behavior*, *27*(1), 23–43. https://doi.org/10.1007/bf03393090

Sundberg, M. L., & Michael, J. (2001). The benefits of Skinner's analysis of verbal behavior for children with autism. *Behavior modification*, *25*(5), 698-724.

Tager-Flusberg H. (2000). The challenge of studying language development in autism. In Menn, L., & Ratner, N. B. (Eds.), *Methods for studying language production* (pp.313–332). Mahwah, NJ: Lawrence Erlbaum Associates.

Tager-Flusberg, H., & Joseph, R. M. (2003). Identifying neurocognitive phenotypes in autism. Philosophical Transactions of the Royal Society, Series, B, 358, 303–314.

Tager-Flusberg, H., Paul, R., & Lord, C. (2013). Language and Communication in Autism. *Handbook of autism and pervasive developmental disorders*, 1, 335–364. https://doi.org/10.1002/9780470939345.ch12

Thurm, A., Lord, C., Lee, L., & Newschaffer, C. (2007). Predictors of language acquisition in preschool children with autism spectrum disorders. Journal of Autism and Developmental Disorders, 37, 1721–1734.

Venter, A., Lord, C., & Schopler, E. (1992). A follow-up study of highfunctioning autistic children. Journal of Child Psychology and Psychiatry, 33, 489–597. doi:10.1111/j.1469-7610.1992.tb00887.x.

Warren, S. F., & Brady, N. C. (2007). The role of maternal responsivity in the development of children with intellectual disabilities. Mental Retardation and Developmental Disabilities, 13, 330–338

Wetherby, A. M., Cain, D. H., Yonclas, D. G., & Walker, V. G. (1988). Analysis of intentional communication of normal children from the prelinguistic to the multiword stage. Journal of

Wetherby, A., Guthrie, W., Woods, J., Schatschneider, C., Holland, R. D., Morgan, L., & Lord, C. (2014). Parent-implemented social intervention for toddlers with autism. An RCT. Pediatrics, 134, 1084–1093.

Winokur, S. (1976). A primer of verbal behavior: An operant view. Englewood Cliffs, NJ: Prentice-Hall.

Yoder, P. J., Watson, L. R., & Lambert, W. (2015). Value-added predictors of expressive and receptive language growth in initially nonverbal preschoolers with autism spectrum disorders. Journal of Autism and Developmental Disorders, 45, 1254–1270.

Zubrick, S. R., Taylor, C. L., Rice, M. L., & Slegers, D. W. (2007). Late language emergence at 24 months: An epidemiological study of prevalence, predictors, and covariates. Journal of Speech, Language, and Hearing Research, 50(6), 1562–1592.

VITA

Isabelle Bankston graduated from the University of Texas at Austin in 2018 with a Bachelor of Science degree in Communication Sciences and Disorders. Following graduation, she began the pursuit of the degree of Master of Arts in Communication Sciences and Disorders at Louisiana State University in pursuit of becoming a Speech-Language Pathologist. She anticipates graduating with her master's degree in May 2020 and will begin her career serving individuals in need of speech and language intervention.