COMPARING ACQUISITION RATES OF VOCAL MANDS IN CHILDREN WITH AUTISM: VOCAL ALONE vs. MODIFIED TOTAL COMMUNCATION

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ABSTRACT

Total communication (TC) involves the teaching of a manual sign language response while simultaneously presenting the corresponding vocal stimulus. TC procedures have been shown to increase the acquisition of vocal responding for children with autism spectrum disorder (ASD). This study attempted to systematically replicate the findings in Carbone et al. (2006), who found TC training to have a superior advantage over vocal alone (VA) procedures in the acquisition of vocal tacts. An alternating treatments design with initial baseline was implemented to compare two conditions in teaching vocal mands to children with ASD. In the VA condition, the researcher presented a vocal prompt to evoke vocal behavior. In the modified total communication (MTC) condition, the researcher presented the vocal prompt along with the corresponding manual sign. Participants were only required to vocally respond to produce reinforcement in both conditions. Sign language responses also produced reinforcement. Four children diagnosed with ASD and varying speech delays participated in this study. A multiple stimulus without replacement (MSWO) preference assessment (DeLeon & Iwata, 1996) was used to identify each participants' preference to 15- 20 different stimuli. Following baseline, one to two highly preferred target stimuli were assigned to each condition. Four sessions were conducted during the intervention phase, two sessions of the VA condition and two sessions of the MTC condition. Conditions were counterbalanced by alternating each session with no more than two consecutive sessions of the same condition introduced first to control for sequential confounds. Sessions included three trial presentations of each stimulus. Sessions took place one to three times a week. Previous research suggested MTC to have an advantage in higher acquisition rates of vocal responses than the VA condition. The study outcome led to mixed results; three

participants demonstrated slightly better acquisition of vocal mands in the MTC condition compared to the VA condition. The MTC condition also yielded slightly better acquisition of full word vocalizations and independent vocalizations for two participants. Results of this study were marginal and inconsistent but could suggest MTC training to have a slight advantage in the acquisition of vocal responses in individuals with speech delays. It also appears that teaching sign language to individuals with communication delays does not hinder natural speech development.

Keywords: Vocal alone, total communication, modified total communication, manding, vocal prompt, alternating treatments design, autism spectrum disorder

DEDICATION

Mom and dad, I credit all my success to your unconditional love and support throughout my life. Your devotion and encouragement nurtured my dreams into true achievements. Through your example, you have taught me the importance and value of an education and finding success. I am forever grateful for the woman you raised me to be.

Alex, you have supported me through this journey with patience and reassurance. Your love and commitment to me and our future is more than I could have ever ask for. I will love you always.

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CHAPTER 1

REVIEW OF LITERATURE

Comparing Acquisition Rates of Vocal Mands in Children with Autism: Vocal Alone vs. Modified Total Communication

A mand is a verbal response that specifies the reinforcer (Catania, 2013; Skinner, 1957). Establishing operations (e.g., deprivation, aversive stimulation) control the topography of a mand and suggest a consequence of specific reinforcement (Pierce & Cheney, 2013). For example, someone who has just gone on a run may request a glass of water from the person standing in the kitchen. Deprivation of water serves as the establishing operation, the presence of the listener and the availability of water in the kitchen sets the occasion for the mand to occur. The listener is likely to respond accurately to the mand of the speaker because the request for 'water' also functions as the specific reinforcer for the speaker.

Communication Deficits in Individuals with ASD

Children with autism spectrum disorder (ASD) often face functional limitations, resulting in social and language deficits. Individuals with ASD may exhibit "persistent deficits in social communication and social interactions across context" (DSM-V, American Psychiatric Association, 2013). Individuals with ASD may fail to respond appropriately in social situations. Pragmatic Language Disorders (PLD) are common in individuals with ASD. Communication deficits often manifest in early childhood.

Young, Diehl, Morris, Hyman, and Bennetto (2005) compared the results of the Test of Pragmatic Language (TOPL) that assesses how well a student can make meaningful contributions to a topic through appropriate conversation, asking questions, avoiding repetitions, and using appropriate strategies for getting attention (not

interrupting). The researchers also evaluated the results of the Strong Narrative Assessment Procedure (SNAP) which assesses the student's ability to recall information, summarize, and answer comprehension questions about the text.

Participants were 17 children and adolescents diagnosed with high functioning ASD. A control group of 17 students, without ASD, also served as the participants for this study. Students were matched according to similar verbal IQ scores. Results of the study showed participants without ASD scored higher on the TOPL. Participants with ASD scored below the control group in making meaningful contributions about the text. This would suggest that children with ASD, regardless of IQ score, may still have a disadvantage in participating in social routines, joining in, or contributing to conversations, and appropriately responding to the emotions of others.

Poor pragmatic skills can result in a lack of communicative abilities. Breakdowns in communication occur when an individual fails to appropriately respond in a certain context and the response is not met with reinforcement (Mancil, G. R., 2006). Children with ASD that have limited functional language may become reluctant to communicate when previous interactions have not been reinforced (Bishop, 2000). Problem behaviors may occur in children who lack a functional communicative response (Carr & Durand, 1985). Durand and Carr (1991) used mand training to teach participants responses (e.g., "I don't understand" and "No, that's not correct") that generalized across people and different situations. Problem behaviors decreased in all participants and across different settings.

Mand Training

Mand training is a necessary first step in training a verbal repertoire (Drash, P. W., High, R. L., & Tudor, R. M., 1999). In initial mand training, the response is

immediately met with the specified, usually unconditioned, reinforcer. This reinforces the use of language, therefore, making it more likely to occur in the future. The individual is more likely to emit verbal responses when similar, trained responses were previously met with reinforcement. Incidental teaching, choice making, and interrupted behavior chains are just some of the ways mand training can occur.

Incidental teaching is conducted in the child's natural environment and occurs throughout the day instead of during intensive teaching trials (Charlop-Christy & Carpenter, 2000). The leaner typically initiates opportunities to mand for an item. The trainer can arrange the environment so preferred items are visible but out of reach. The response form in a choice making intervention is often part mand, part tact, and part intraverbal (Peck et. al., 2005). For example, the listener may respond to the verbal stimulus, "Do you want this or that?" when presented with two or more objects.

An interrupted behavior chain procedure involves the trainer contriving the events so that an essential item in a chain of behaviors is missing (Albert, Carbone, Murray, Hagerty, & Sweeney-Kerwin, 2012). The learner must mand for the item without the physical presence of the item to complete the chain of responses. For example, the trainer may hide the milk when the learner is making cereal, this may increase the likelihood that the learner will mand for milk.

Children with ASD can sometimes struggle to acquire a repertoire of vocal mands (Sautter, & LeBlanc, 2006). Problem behaviors are common in individuals who have a language deficit. It has been suggested that the problem behaviors and a form of communication can be equivalent in function and therefore teaching functional language can be an effective intervention for problem behavior (Carr & Durand, 1985). It is recommended that individuals with language delays are first taught to make requests in

order to prevent development of problem behavior (Reichle, Mirenda, Locke, Piche & Johnston, 1992). Other verbal operants (e.g., tacts, intraverbals, etc.) are reinforced by a social reinforcer, such as praise and attention.

Social reinforcement is not always motivating for some individuals with ASD. For example, in mand training, the speaker immediately benefits from the response because the reinforcer is usually an edible or a preferred item. Highly preferred foods and activities are often the first items an individual is taught to request in mand training. Requests for help, attention, and information are taught after the individual has acquired a repertoire of verbal mands.

Augmentative and Alternative Communication

Some professionals have hesitated to implement an augmentative and alternative communication (AAC) intervention for fear that the alternative communication method would hinder natural speech development (Drager, Light, & McNaughton, 2010). In a review of research conducted by Schlosser and Wendt (2008), none of the participants in the included studies on AAC where speech was measured experienced a decreased in their speech production. In some studies, an increase in speech was reported (e.g., Ticani, 2004; Tincani, Crozier & Alazetta, 2006; Charlop-Christy, Carpenter, LeBlanc & Kellet, 2002; Ganz, Simpson & Corbin-Newsome, 2007; Travis, 2006; Olive et al., 2007).

Total Communication

Total communication (TC) training is a procedure to teach sign language to children with ASD and other developmental delays. TC procedures involve training both the vocal and manual sign language response when teaching verbal operants to individuals with speech delays (Carbone et al., 2006). Reinforcement for correct responding is provided when the individual emits both the vocal and sign language

response simultaneously. TC procedures have been shown to be effective in increasing vocal responses in children with developmental delays (e.g. Richard, 2013; Carbone, Sweeney-Kerwin & Attanasio, 2010).

Valentino and Shillingsburg (2011) found fast acquisition rates of signed mands, tacts, and intraverbals when verbal operants were taught to a male child with ASD. Carbone et al. (2006) evaluated the efficiency of acquisition rates on vocal tacts when comparing a TC procedure which involved the teaching of manual sign language with the corresponding spoken word to a vocal alone (VA) condition. The participant in this study required fewer teaching trials to produce four times as many vocal tacts in the TC condition.

VA procedures alone may be ineffective when teaching vocal responses to an individual with a hearing impairment or a language delay. Wells (1981) found TC procedures to improve the articulation in children with developmental delays. Researchers used an audio recording to document a baseline of the participants' articulation of the target words. Responses in the traditional training method (vocal alone) were reinforced if the articulation of the response was the same or better than the baseline recording of the target word.

In the TC condition responses were reinforced if the articulation of the response was the same or better and the participant presented the corresponding sign language response. Articulation of the target words in both conditions increased for two of the three participants. The results from all three participants showed a clear advantage in the TC condition in improving the articulation of age-appropriate responses in children with developmental delays.

A study conducted by Linton and Singh (1984) found significantly higher acquisition rates in vocal responding when an over-correction procedure was paired with a positive reinforcement system to train TC responses. Tincani (2004) compared the Picture Exchange Communication System (PECS) and TC training in the acquisition of vocal mands. For one participant, TC training produced a higher percentage of independent vocalized mands. Carbone and Sweeney-Kerwin, et al. (2010), also found an increase in unprompted vocal responses when combining TC training with a prompt delay.

Previous studies have shown TC procedures to have an advantage in training vocal responses compared to VA training for children with ASD (e.g., Barrera & Sulzer-Azaroff, 1983; Sisson & Barrett, 1984). TC procedures have also had an advantage on the development of vocal speech in infants without any known diagnosis (Goodwyn, Acredolo & Brown, 2000). One possible reason for this result is the development of communication between the listener and speaker. Symbolic gesturing to request or label an object emitted by the speaker invites the listener to use language. A child may emit a sign language response to request 'milk', the caregiver may vocally reply with, "here's your milk, it's nice and cold." Exposure to additional language opportunities may increase the likelihood that the child will emit a communicative response in the future.

Speech is the most commonly used form of communication between individuals. In a speaking community, where the caregivers are not trained to communicate using AAC, a vocal prompt may be the child's only exposure to language. Caregivers and therapeutic staff may be unaware or misinformed of the benefits TC procedures may have on the development of natural speech. Further replication comparing the two conditions

will provide validity that TC training may increase the acquisition of vocal responses in children with ASD.

Vocal Alone Training

Children with significant language delays often require prompting to evoke a verbal response. Vocal prompts are commonly used to teach children with ASD to mand for and tact stimuli in their environment (e.g., Williams, Carnerero & Pérez-González, 2006; Ringdahl et al., 2009). However, vocal prompts may be difficult to eliminate by fading and the individual may become prompt dependent (Vedora, Meunier & Mackay, 2009). Brady and Smouse (1978) found VA procedures to be less effective at evoking verbal responses than TC training.

Modified Total Communication

Total communication procedures require the participant to respond with both the vocalization and sign language response to receive reinforcement. In a modified total communication (MTC) procedure participants are prompted to emit the sign language response and corresponding spoken word; however, reinforcement is provided if the participant only vocally responds (Barrett & Sisson, 1987). Reinforcement of the vocal response increases the likelihood that the participant will imitate the response to gain access to the reinforcer.

Vocal responding is universally used by the speaking community. MTC procedures train the participant to respond in two different response forms. However, reinforcement of the vocal response, without requiring the corresponding sign language response, may increase the likelihood that vocal responding will be the stronger response form used by the participant.

The presentation of the discriminative stimulus (S^D), the vocal prompt, in addition to the sign language response, may increase the likelihood of vocal behavior in the future. Vocal prompting alone may be ineffective for the transfer of stimulus control. Visual stimuli are often used to teach individuals with ASD different skills. The sign language response is a visual stimulus that serves as a second S^D and sets the occasion for the vocal response to occur. After the participant has acquired the manual sign language response, he or she can emit the response in settings without the presence of the researcher. The repeated use of the sign language response increases the opportunities to emit the vocal response, therefore, increasing the likelihood of vocal behavior.

Present Study

The present study attempted a systematic replication to extend the findings in the Carbone et al. (2006) research. Carbone et al. compared TC and VA procedures when training vocal tacts to a seven-year old girl diagnosed with ASD. Researchers presented a visual picture card of a stimulus to the participant. The trainer prompted the correct response, followed by the question, “What is it?” After the participant responded, the stimulus was removed for 3 s and presented again with the question, “What is it?”

The participant received reinforcement in the form of verbal praise for correct responding in the Carbone et al. study. The sign language response was also required to produce reinforcement in the TC condition. Any error in responding resulted in the immediate re-presentation of the stimulus. Results of the Carbone et al. study found TC training to have an advantage over VA procedures in the acquisition of vocal tacts. The participant also required less than half of the average trials to criterion in the TC condition compared to the VA condition.

The researcher of the current study implemented an alternating treatments design with an initial baseline to compare two conditions, vocal alone (VA) and modified total communication (MTC), by measuring the acquisition rates of vocal manding in children with ASD. The VA condition involved only the vocal presentation of a target stimulus by the researcher. The MTC condition involved the presentation of both a vocal and manual sign language prompt of the target stimulus. Only the vocal response was required in both conditions to produce reinforcement. The occurrence of the sign language response also produced reinforcement but was not required. MTC procedures used in the current study differed from TC procedures used in Carbone et al., to determine the effects of sign language prompting on vocal responding. Sign language responses were recorded for analysis.

Research Question 1. What are the differential effects of vocal alone (VA) and modified total communication (MTC) procedures on the acquisition of vocal mands (i.e., full word vocalizations and partial word vocalizations) in children with ASD?

Research Question 2. What are the differential effects of vocal alone (VA) and modified total communication (MTC) procedures on vocal mands (i.e., full word vocalizations and partial word vocalizations) when mastered target responses were presented again an average of 14 days (range: 12- 16) post-intervention in children with ASD?

CHAPTER 2

METHOD

Participants

Participants selected for this study scored below a 5 (Level 1) when assessed using the mand section of the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP; Sundberg, M. L., 2008). All individuals who scored above a 5 were excluded. A score above 5 on the Mand section of the VB-MAPP indicates the individual can spontaneously emit previously learned mands and emit new mands without specific training. Therefore, all participants recruited for this study were individuals with limited vocal responses, as indicated by a Level 1 score on the VB-MAPP, which specifies that the individual has a vocal repertoire of less than 10 independent mands. Recruitment criteria also included that participants must imitate 10 out of 20 different fine motor actions when presented with a full physical prompt and the vocal prompt "do this."

To recruit participants, the researcher contacted local doctors' offices, ASD resource agencies, and colleagues. Notices for participation, such as flyers, were distributed through email, social media outlets, and displayed in the main office of local businesses for potential participants to observe. Participants were considered upon the referral of their parent or legal guardian. Parents or guardians of potential participants contacted the researcher with interest to participate in the intervention described.

It was preferred, but not required, that participants already have some experience with discrete trial teaching. Three out of the four participants had either received or were receiving intensive teaching based in the principles of applied behavior analysis (ABA). It was adventitious for the researcher to work with children that had previously been exposed to discrete trial teaching and reinforcement schedules. This may have increased

the likelihood of responding. The three participants were pre-exposed to sitting at and working at a table in the home. The participants did not need a history of sign language training to participate in this study.

Four individuals (Anna, Bob, Laura, Dave), under the age of six, served as the participants for this study. Participants received 2-6 hours of intervention presented in a discrete trial format per week. The intervention was conducted in the home setting. In between sessions the researcher and participant participated in cooperative play. One researcher conducted the intervention and recorded data for all sessions. The study was carried out in the same room and at the same table for every intervention for each participant; intervention times varied. The researcher presented materials when sitting next to or across from the participant.

Anna. Anna was a 5-year-old, Asian-American girl. She was diagnosed with ASD when she was two-years-old. She attended an autism support classroom during school hours and received intensive teaching, based on the principles of ABA, in the home. Anna's parents were bilingual but only spoke English to Anna. Anna presented strong echoic skills and had a few independent mands that she repeated to gain access to a desired item or action (i.e., pick up, open, juice, snoopy). These mands were under stimulus control. Prior to intervention, Anna's mand repertoire was assessed using the mand section of the VB-MAPP; Anna scored a 4.5 (out of 5) and qualified for participation in this study.

Anna had a limited repertoire of independent vocal mands. In order to gain access to most stimuli, Anna would guide a caretaker to the area where the item she desired was located. She would point to or motion for an item, at that point her parent was observed to begin vocally and visually suggesting items. Anna would repeat back the name of

some items but push away items until the item that she desired was presented to her. Most attempts to increase Anna's repertoire of vocal mands have resulted in limited responses that require the presence of the stimulus and a vocal prompt. Anna qualified for this study by scoring a 12/20 on the VB-MAPP's fine motor imitation assessment.

Bob. Bob was a four-year-old Caucasian boy. He was diagnosed with ASD when he was 18 months old. Bob attended an autism support classroom during school hours. He had previously received intensive teaching, based on the principles of ABA in the home. During this study Bob did not receive home based intervention outside of participation in this research. Bob had a strong echoic repertoire of mands and tacts. Bob had some independent mands (i.e., binky, mommy, daddy, juice); he scored a 3.5 (out of 5) on the mand section of the VB-MAPP. Bob spontaneously manded for his pacifier ("binky") when the item was not present. He was not observed to spontaneously mand for other stimuli.

Bob often engaged in problem behaviors (i.e., crying, dropping to floor, whining), his mother would then vocally prompt him to request for a desired item while visually presenting different items to him. Bob continued to engage in these behaviors until he gained access to the desired item. Bob had a limited repertoire of independent vocal mands. He also qualified for this study by scoring a 12/20 on the VB-MAPP's fine motor imitation assessment.

Dave. Dave was a four-year-old, Ethiopian boy. He was diagnosed with ASD when he was 3-years-old. He attended a preschool for children with developmental delays during the school day. Dave also received intensive teaching, based on the principles of ABA, in the home. Dave's parents were bilingual and spoke both languages to Dave with the emphasis on English. Dave had a limited repertoire of independent

vocal mands. Dave qualified for this study with a score of 2 (out of 5) on the mand section of the VB-MAPP. He also scored a 12/20 on the fine motor imitation assessment of the VB-MAPP.

Dave had a moderate echoic repertoire. Dave would sometimes emit an echoic response after the third or fourth vocal prompt. Dave would independently repeat phrases (i.e., “I want it”, “I want go”, “pick up”) to mand for various stimuli and actions of others. To gain access to a desired item Dave was observed to elope to where the item (i.e., iPad, TV remote, fruit snacks) was stored and point to/ grab at the item. Dave’s mother usually attended to Dave’s needs and provided him with the item. Dave was observed to engage in problem behaviors (i.e., crying, dropping, eloping) when he was denied access to a desired item.

Laura. Laura was a four-year-old, Ethiopian girl diagnosed with ASD. She attended a preschool for children with developmental delays during the school day. This was Laura’s first exposure to the school setting. She had never received intensive teaching in the home, outside of this study. Laura’s parents were bilingual but only spoke English to Laura. Laura had a very limited repertoire of independent vocal mands. She scored a 1.5 (out of 5) on the mand section of the VB-MAPP prior to intervention. Laura was observed to utter echoic vocal responses (e.g., juice, squeeze, up) when presented with the opportunity to gain access to the desired item.

Laura often emitted vocal utterances, sounds, yells, and whistles. Much of Laura’s vocal repertoire was inaudible, or a melody from a song or show. Laura often gained access to desired items by attempting to gain access herself (e.g., climbing on furniture, eloping to a different room). Laura’s parents often provided her access to preferred items (e.g., food, iPad, juice) before Laura attempted to request for it. Laura was also observed

to take her parents hand and guide them to the desired item to gain access if she needed help. Laura often babbled while playing on her iPad and watching TV. Laura also had a limited echoic repertoire. Laura scored a 11/20 on the fine motor imitation assessment on the VB-MAPP which qualified her for participation in this study.

Setting

Intervention and data collection occurred in each participant's family home. Data collection, including baseline, intervention, and follow up, took 16 weeks to complete. The intervention was conducted on child-sized tables and chairs. Stimuli that were not related to the experiment, such as toys, siblings, and food were placed out of reach and visibility and not permitted at the table during intervention. The researcher and participant sat with their backs to environmental stimuli in order to control for extraneous variables. Sessions were conducted in either the basement, living room, or dining room of the participants' homes. Stimuli such as family members, food preparation, and electronics were present in other rooms, such as the kitchen and family room.

Materials

A three-trial data sheet was used during each session to record vocal responses emitted by the participant. An independent observer used the same data sheet to collect Interobserver Agreement (IOA) data. A procedural fidelity checklist was also used by the independent observer to indicate the researcher had completed each task in the procedure as it is presented in this study. The researcher used her personal laptop to video record VA and MTC conditions for IOA and procedural fidelity. A child-size table and chairs, owned by the families, were used to conduct this intervention. The researcher obtained and remained in possession of 15- 20 various toys, activity bins, and videos that were introduced during the preference assessment (described below).

Experimental Design

An alternating treatments design within initial baseline was used to determine the effects of VA procedures when compared to MTC training in the acquisition of vocal responses in children with ASD. Presentation of conditions were counterbalanced by alternating each session with no more than two consecutive sessions of the same condition introduced first to control for sequential confounds. After 15- 20 target stimuli were observed to produce no response in baseline, the researcher began implementation of the alternating treatments design.

Measurement

Intervention took place one to three times a week and did not last more than 90 minutes per day. The researcher recorded responses of the dependent variables. Four sessions were conducted each day of intervention; two sessions conducted in the VA condition and two sessions conducted in the MTC condition. Three trials of each target response were conducted during each session. One to two stimuli were presented in each condition. Sessions of each condition were alternated during intervention phase.

Dependent Variables

The main dependent variables measured in this study were the cumulative amount of full word vocalizations and partial word vocalizations acquired through VA and MTC training. During intervention, the researcher also measured secondary dependent variables including the occurrence of independent vocalizations and sign language responses.

Full word vocalizations. Full word vocalizations were recorded when the response included any vocalized, clearly understood word made by the participant, independently or prompted; with or without the presence of the stimulus. Acceptable full

word vocalizations included clear echoic imitations of the researcher's vocal presentation (i.e., all syllables must be present, beginning and ending sounds are the same). Full word vocalizations did not include any incorrect word or utterance made by the participant.

Partial word vocalizations. Partial word vocalizations were recorded when the response included any vocal utterance made by the participant, independently or prompted, that was not a full word vocalization. Examples included, "ba" for the target response *ball* and "inky" for the target response *slinky*.

Independent Vocalizations. Independent vocalizations were recorded if the participant emitted a full word vocalization or a partial word vocalization of the target response, with or without the presence of the stimulus, before any vocal or sign language prompt had been provided by the researcher.

Sign Language Responses. When the target stimulus was presented the researcher provided a full physical prompt of the sign language response along with the corresponding vocal prompt. Sign language responses were recorded if the participant responded by imitating the sign language response when the target stimulus was presented again. Emitted sign language responses were scored as either yes (Y) or no (N). Some approximations of the sign language responses were accepted. For example, the sign for ball involves both hands making a clapping pattern but not touching with fingers slightly bent. If the participant emitted a sign language response for ball however, their fingers were slightly straight, the response was recorded as correct.

Mastery of target responses in both conditions required either a full word vocalization or partial word vocalization to occur in all three training trials across two consecutive sessions. If the participant did not score 100% across two consecutive training sessions, the response was not considered mastered. New target responses were

introduced in each condition after target responses had been mastered. Highly preferred items were the first stimuli introduced to participants. New target responses were chosen based on results of the preference assessment (described below). Mastered items were re-assessed an average of two weeks (range: 12 – 16 days) after intervention.

Procedures

Preference Assessment. Indirect observations and conversations with the participants' parents were conducted to determine 15 to 20 potential target reinforcers for each participant. The stimulus was displayed at eye level. If the participant showed a motivation (e.g., reaching for, pointing to, or looking at) for the item and failed to vocally request the item within 10 s or responded incorrectly, the item was chosen for a preference assessment.

A multiple stimulus without replacement preference assessment (MSWO; DeLeon & Iwata, 1996) was used to identify each child's preference to a variety of stimuli. Each preference assessment took place at a child size table, no other individual or distracting materials (i.e., siblings, television) were present during the preference assessment. Four to six stimuli were arranged randomly in an array and presented to the participant. The researcher said, "pick one." Once the participant selected an item, they received access to the item for 30 s. Access to all other items in the array were blocked. If the participant touched two items, access was given to the first item touched.

The selected item was removed from the next presentation of items. The remaining stimuli were rearranged by moving the stimulus on the left end to the right end. The stimuli were presented to the participant again for selection. This procedure continued until all stimuli were selected or until the participant made no selection after 30 s. Three trials were conducted to determine a stable preference. If stability was not

determined, the trial was repeated five times. The preference assessment continued until at least two items have been chosen from every category to be evenly distributed in each condition (described below).

Results of the preference assessment determined the even distribution of target responses in each condition. Preferred items were arranged into categories. Categories differed for each participant; examples included: activity bins (i.e., playdough, sand), videos (i.e., 'Let It Go', 'Trolls'), and toys (i.e., monkey, ball). The selected stimuli were equally distributed to the two conditions according to preference. For example, responses for two different highly preferred items from the activity bin category were each distributed to the VA and MTC condition. The items were divided between the two conditions to control for responding based on preference for specific items.

Highly preferred items were chosen as the first targets to be introduced. The two highest preferred items were distributed in each condition to control for responding based on preference. For example, if a participant's highest preferred item was sand and their second highest preferred item was a monkey then both target stimuli would be presented as the first targets introduced; one in the VA condition and one in the MTC condition. If the participant preferred playdough as their third highest preferred item then playdough would be introduced in the opposite condition as sand to control for responding to preference of similar stimuli.

General Procedures. Intervention sessions took place one to three times per week for approximately 60- 90 minutes. At least four sessions were conducted during each day of intervention; two sessions in the VA condition and two sessions in the MTC condition. No more than eight sessions took place in one day. As the participant gained a

vocal repertoire of echoic mands in either condition, the next highly preferred target response was introduced.

Prior to baseline, the researcher and participant engaged in 10-15 minutes of pairing activities (i.e., blowing bubbles, singing songs, playing outside). This may have increased the likelihood that the child found the researcher reinforcing and may have increased the likelihood the child would emit vocal responses in the presence of the researcher when intervention began. Target stimuli were not used during pairing activities.

During intervention the researcher recorded whether the participant vocally responded with a full word vocalization (W) or a partial word vocalization (A) during each trial by indicating yes (Y) or no (N). The researcher also documented any occurrence of independent vocalizations. Data collection for both conditions were the same. However, in the MTC condition, the researcher also recorded whether the participant imitated the sign language response. While presenting the full vocal prompt, the researcher simultaneously provided a full physical prompt of the sign language response. A full physical (FP) prompt involved the researcher fully manipulating the participant's hands and arms to accurately produce the sign language response.

Baseline. During baseline, each trial began with the researcher and participant sitting at a child sized table. The researcher held up the desired stimulus at the child's eye level to signal the availability of the item. If the child did not show a motivation (e.g., putting head down or looking away) for the stimulus after 5 s, the researcher prompted the child to make eye contact with the item and observe the researcher modeling how to use the item. This was done to ensure that the individual's "lack of motivation" was not

due to unfamiliarity with the item. The stimulus was presented again, if the child did not approach the item within 5 s it was removed.

If the participant showed a motivation (e.g., reaching for, pointing to, or looking at) for the stimulus and emitted a full word vocalization or a partial word vocalization within 5 s, immediate reinforcement in the form of access to the item was delivered. A stimulus was not chosen for intervention if the participant emitted a full word vocalization or partial word vocalization of the item when presented in baseline. Vocal responses did not occur during baseline.

If a stimulus was presented and the participant showed a motivation for the item but did not emit a vocal response within 5 s, the researcher waited an additional 5 s. If the participant still did not emit a vocal response after the 10 s, access to the item was provided for 30 s. The stimulus was then chosen for intervention. Access for no response during baseline may have decreased the likelihood that problem behaviors would occur. If a participant emitted a sign language response for an item but did not vocally request it, access to the item was provided. The stimulus was still chosen for the intervention.

Vocal Alone. In the VA condition, presentation of the stimulus followed the same protocol described in baseline. The researcher and participant sat at a child size table. The researcher held up the preferred item at the child's eye level to signal the availability of the item. The researcher allowed 1- 2 s of wait time for the child to show a motivation (e.g., reaching for, pointing to or looking at) for the stimulus. An independent vocalization was recorded if the participant emitted a full word vocalization or a partial word vocalization prior to the researcher providing a full vocal (FV) prompt. A FV prompt required the researcher to present the full word vocalization during the presentation of the target response.

After the participant showed a motivation for the stimulus and no occurrence of an independent vocalization was recorded, the researcher provided a FV prompt. The researcher allowed a wait time of 10 s for the participant to emit a full word vocalization or a partial word vocalization. If the participant did not vocally respond within 10 s or responded incorrectly, the item was removed. The trial was scored as incorrect (N) and the stimulus was re-presented in a new trial.

After the participant responded with either a full word vocalization or a partial word vocalization, reinforcement in the form of verbal praise was provided. An example of verbal praise included, “ball, that’s right.” The researcher first presented the vocal name of the target response as verbal praise to provide specific reinforcement of the target response. The item was then removed for 3 s. Access to the stimulus was not yet provided.

The stimulus was presented again at the participant’s eye level. The researcher paused for 3 s to allow for the transfer of stimulus control. The trial was scored as correct (Y) if the participant emitted a full word vocalization or a partial word vocalization. Reinforcement in the form of access to the item and verbal praise (i.e., “ball, here’s ball”) was also provided. Incorrect and no responding (N) was recorded if the participant did not emit a vocal response after the second presentation of the target stimulus, access to the stimulus was not provided. This trial was repeated three times during each session.

Modified Total Communication. In the MTC condition, the researcher presented the stimulus in the same way as the VA condition. The researcher and participant sat at a child size table. The researcher held up the preferred item at the child’s eye level to signal the availability of the item. The researcher allowed 1- 2 s of wait time for the child to show a motivation (e.g., reaching for, pointing to or looking at) for the stimulus. An

independent vocalization was recorded if the participant emitted a full word vocalization or a partial word vocalization prior to the researcher providing a FV or manual sign language prompt.

Sign language used in this study was not precise American Sign Language (ASL). Responses were simplified to manual sign language. For example, a person of the deaf community may request in sign language “I want ball.” For the purpose of this study, the mand for ‘ball’ was taught by training the manual sign language response for only ‘ball.’ The researcher implemented full physical prompting of the manual sign language response.

After the participant showed a motivation for the stimulus and no occurrence of an independent vocalization was recorded, the researcher presented the FV prompt while simultaneously providing the full physical prompt (hand over hand guidance) of the sign language response. The researcher allowed a wait time of 10 s for the participant to emit either a full word vocalization or a partial word vocalization. If the participant did not vocally respond within 10 s or responded incorrectly, the item was removed. The trial was scored as incorrect (N) and the stimulus was re-presented in a new trial. If the participant did not emit the sign language response when the item was presented again, the researcher implemented a full physical prompt of the response.

After the participant responded with either a full word vocalization or a partial word vocalization, reinforcement in the form of verbal praise was provided. Examples of verbal praise included, “ball, that’s right.” The researcher first presented the vocal name of the target response as verbal praise to provide specific reinforcement of the target response. Occurrence and non-occurrence of the sign language response resulted in the

researcher providing a full physical prompt of the response. The item was then removed for 3 s. Access to the item was not yet provided.

The stimulus was presented again at the participant's eye level. The researcher paused for 3 s to allow for the transfer of stimulus control. The trial was scored as correct (Y) if the participant emitted a full word vocalization or a partial word vocalization. Reinforcement in the form of access to the item and verbal praise (i.e., "ball, here's ball") was provided. Reinforcement was provided if the participant only vocally responded with a full word vocalization or partial word vocalization of the target response. Access to the item was also provided if the participant only responded with the sign language response.

Incorrect and no responding (N) were recorded if the participant did not emit a vocal response after the second presentation of the target stimulus, access to the stimulus was not provided. Full physical prompting was implemented for any occurrence and non-occurrence of the sign language response. This was done to reinforce the use the sign language response and correct any incorrect or nonoccurrence of the sign language response. This trial was repeated three times during each session.

Post-experimental Procedures. Individual access to each stimulus was provided to the participant after all experimental conditions ended for that day. This ensured the participant did not lose interest in the item and may have increased the motivation to obtain access to the item in future sessions. The researcher held up the desired item at the participant's eye level to signal the availability of the item. If the participant did not show a motivation for the stimulus after 5 s, the researcher moved the item closer to the participant without fully providing access to the item. If the participant did not respond after another 5 s, the researcher removed the item and presented a new stimulus. If the participant showed a motivation for the stimulus when presented, the researcher

immediately provided access to the item. Access to each item lasted an average of two minutes.

Follow Up. An average of 14 days (12-16) after the completion of intervention follow up sessions of mastered vocal responses were conducted in both the VA and MTC conditions. Sessions conducted were identical to experimental conditions described in VA and MTC.

Interobserver Agreement

In addition to implementing experimental procedures, dependent variable data were collected by the researcher. A second observer's data were used to calculate IOA percentages. IOA data was conducted to determine the believability of the procedures presented in this study. Secondary data were collected from video recorded sessions. At the conclusion of this study the IOA observer was compensated for his participation.

The additional observer was trained to record the occurrence of correct and incorrect responses. Training took place in an empty classroom at Temple University. The researcher trained the secondary observer through role play. In the notes section on the three-trial data sheet the researcher made a note of an approximate spelling of the partial word vocalizations emitted by the participants for reference in training the secondary observer. The researcher acted as the participant and emitted approximate examples of the response forms of the participants correct and incorrect vocal responses. The secondary observer recorded data on the same three-trial data sheet used by the researcher.

When training began, the researcher had a pre-recorded data sheet with correct and incorrect responses. The secondary observer took data on responses out of view from the researcher so body movements, such as eye contact, did not manipulate the data. IOA

training was also conducted with videotaped sessions of participants. Videos used during training were not counted towards IOA data. Training of an IOA observer met a mastery criterion of 80% of agreement across two training sessions prior to conducting IOA with a participant.

IOA trials were recorded for an average of 37% (range: 36%- 39%) of all baseline, experimental, and follow up phases for all participants. An agreement occurred when the both the researcher and the secondary observer scored the response with the exact same rating. For an agreement to occur, both observers circled the same code when recording the occurrence of the dependent variables (full or partial word vocalizations, independent vocalizations, and the occurrence of the sign language response) for each of the three stimulus presentations.

IOA percentages of agreement were calculated by dividing the total number of agreements/ the total number of responses * 100. The IOA scores for all participants averaged 93% (83% - 100%) for all baseline, experimental, and follow up phases.

Procedural Fidelity

Procedural fidelity ensures the accuracy in the delivery of the intervention. It also provided reliability to future readers that the procedures as described may produce similar results if replicated. Procedural fidelity data were recorded by the same independent observer who collected IOA data. Data was collected for an average of 37% (range: 36%-39%) of all baseline, experimental, and follow up phases. Procedural fidelity data were collected from video recorded sessions. A checklist was designed by the researcher to detail a step-by-step list of the procedures that were implemented in each condition (See Appendices E, F, G).

The researcher trained the secondary observer again through role play. The researcher acted as the trainer and the secondary observer acted as the participant. The secondary observer left blank any step not completed and indicate with an X or a checkmark each step on the list that was completed to accuracy. The researcher had a pre-recorded checklist prior to training. Steps in the sequence were intentionally left out to determine if the secondary observer would provide unbiased data. Procedural fidelity training was also conducted with videotaped sessions of participants. Videos used during training were not counted towards procedural fidelity data. Training of the secondary observer met a mastery criterion of 80% of agreement across two training sessions prior to conducting procedural fidelity with a participant.

A step was scored as completed to accuracy if the step was observed to be completed in each of the three trial presentations. Percentage of procedural fidelity was calculated by dividing the total number of agreement/ the total number of responses * 100. The procedural fidelity scores for all participants averaged 99% (98% - 100%) for all baseline, experimental, and follow up phases.

Social Validity

Social validity was measured through two questionnaires conducted before and after the conclusion of this study (See Appendices H & I). The questionnaire was adapted from the Treatment Acceptability Rating Form (TARF) (Reimers & Wacker, 1988). Each questionnaire contained 10 questions. The first questionnaire conducted prior to the intervention measured answers on a 5-point Likert scale from 1 (not at all) to 5 (very). The first three questions assessed the parent's understanding and comfortability with the researcher and the intervention's application. The next four questions assessed the parent's acceptability and interest in the continuation of the intervention. The last three

questions asked if the parent anticipated that their child would experience discomfort or if the intervention would cause a disruption to their daily routine.

The second questionnaire that was conducted after the conclusion of this study also measured answers on a 5-point Likert scale. The post-intervention questionnaire was similar to the questionnaire conducted prior to experimentation. The first four questions assessed the parent's understanding of the study's results and if they liked and/ or found the study to be beneficial to their child. The parent was also asked if they noticed an increase in their child's vocal responding. The next two questions ask if the parent would recommend this intervention to another parent and whether they are interested in continuing this intervention. The next three questions assessed whether the parent observed their child experiencing discomfort or if they felt their routine was disturbed in any way. The last question was open-ended for the parent to make recommendations to procedures.

CHAPTER 3

RESULTS

Anna. The cumulative number of full word vocalizations and partial word vocalizations Anna acquired in baseline and experimental conditions are represented in Figure 1 below. Anna required six trials to meet the mastery criterion of the first vocal response presented in both the VA and MTC condition. The 11th data point shows Anna had mastered five vocal responses in the VA condition and six vocal responses in the MTC condition. By the last intervention session, Anna had mastered a cumulative number of ten vocal responses in the VA condition and 12 vocal responses in the MTC condition. A total number of 132 trials were conducted in both the VA and MTC conditions.

The cumulative number of full word vocalizations and partial word vocalizations Anna emitted approximately two weeks after intervention are also presented in Figure 1. A total of eight target responses were presented in each condition. Follow up was conducted over 48 trials presented in both the VA and MTC conditions. Anna emitted 7/8 vocal responses in the VA condition; she emitted 8/8 vocal responses in the MTC condition.

Rates of responding occurred at a high rate in the VA and MTC conditions with only a slight difference in the acquisition of responses. A visual analysis of the data presented in Figure 1 would suggest MTC to have a slight advantage in the acquisition of vocal responses.

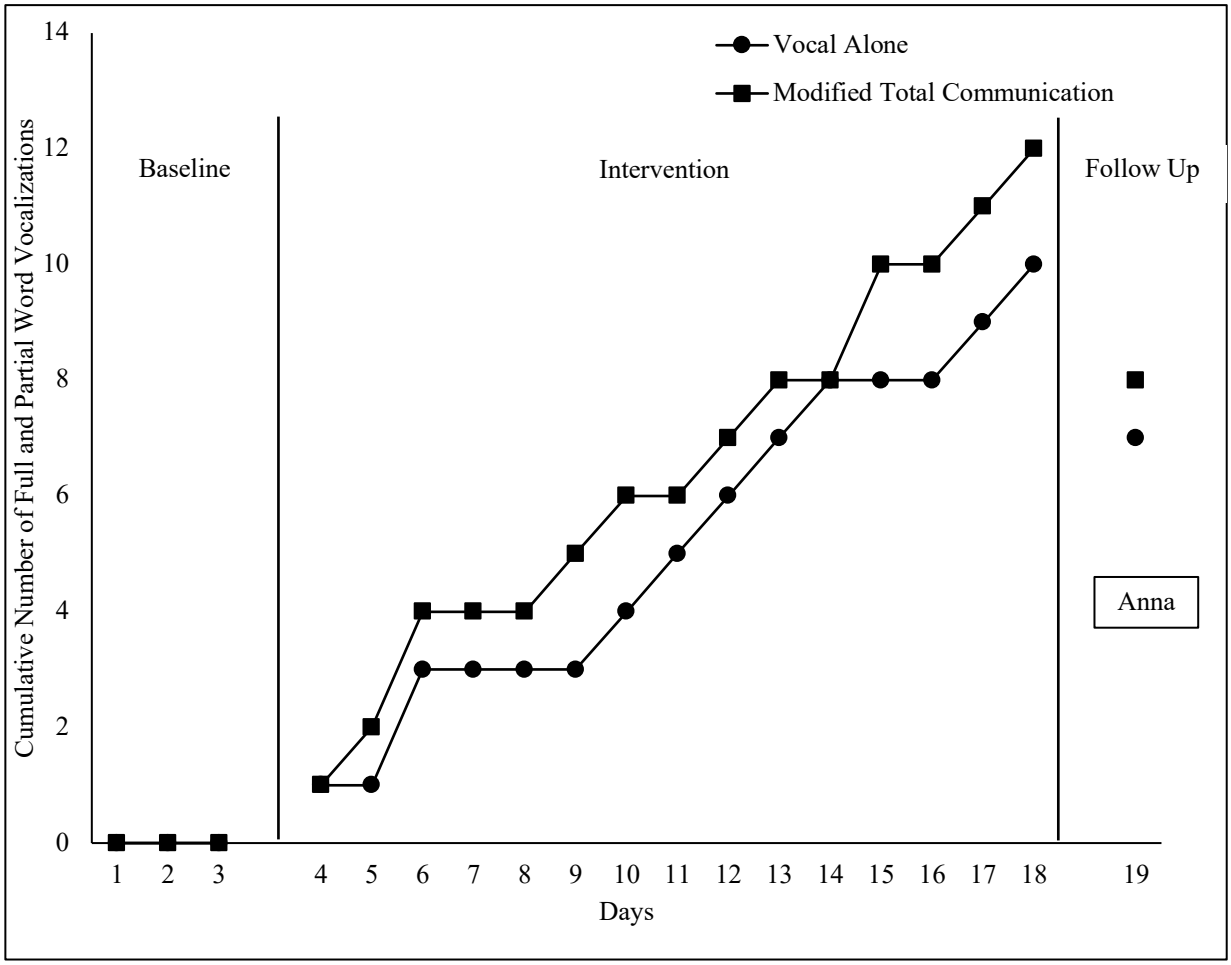

Figure 1. *Cumulative number of full word vocalizations and partial word vocalizations Anna acquired in the vocal alone and modified total communication conditions.*

Figure 2 represents the mean trials to criterion for mastery of full word vocalizations and partial word vocalizations Anna acquired in both the VA and MTC conditions during intervention. Anna required an average of nine trials to reach mastery of vocal responses in the VA condition. Anna required an average of seven trials in the MTC condition to reach mastery criterion. Anna required fewer trials to acquire mastery criterion of target responses in the MTC condition than in the VA condition.

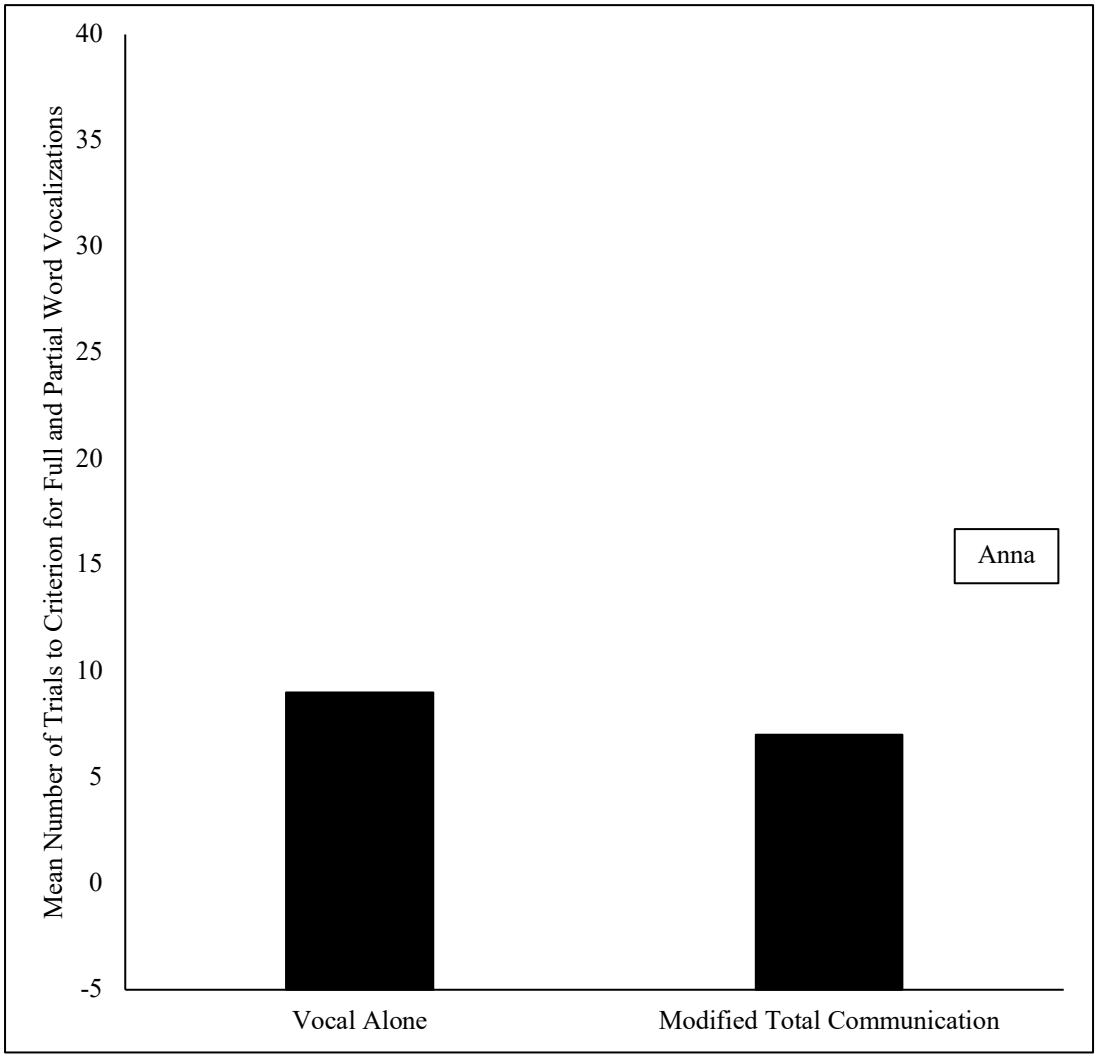

Figure 2. *Mean number of trials to criterion for mastery of full word vocalizations and partial word vocalizations Anna acquired during intervention in the vocal alone and modified total communication conditions.*

Figure 3 represents the cumulative number of full word vocalizations Anna acquired during intervention of both the VA and MTC conditions. Anna acquired her first full word vocalization in the VA condition after six trials. Anna acquired her first full word vocalization after 18 trials in the MTC condition. The 11th data point shows Anna had acquired two full word vocalizations in the VA and MTC conditions. By the last intervention session, Anna had acquired a total of two full word vocalizations in the VA condition and three full word vocalizations in the MTC condition.

The cumulative number of full word vocalizations Anna emitted are also presented in Figure 3. Anna emitted one full word vocalization in the VA condition; she emitted four full word vocalizations in the MTC condition.

There is no clear difference in the acquisition of full word vocalizations during intervention for either the VA or MTC condition. However, MTC appeared to have an advantage over VA training of full word vocalizations in the follow up phase.

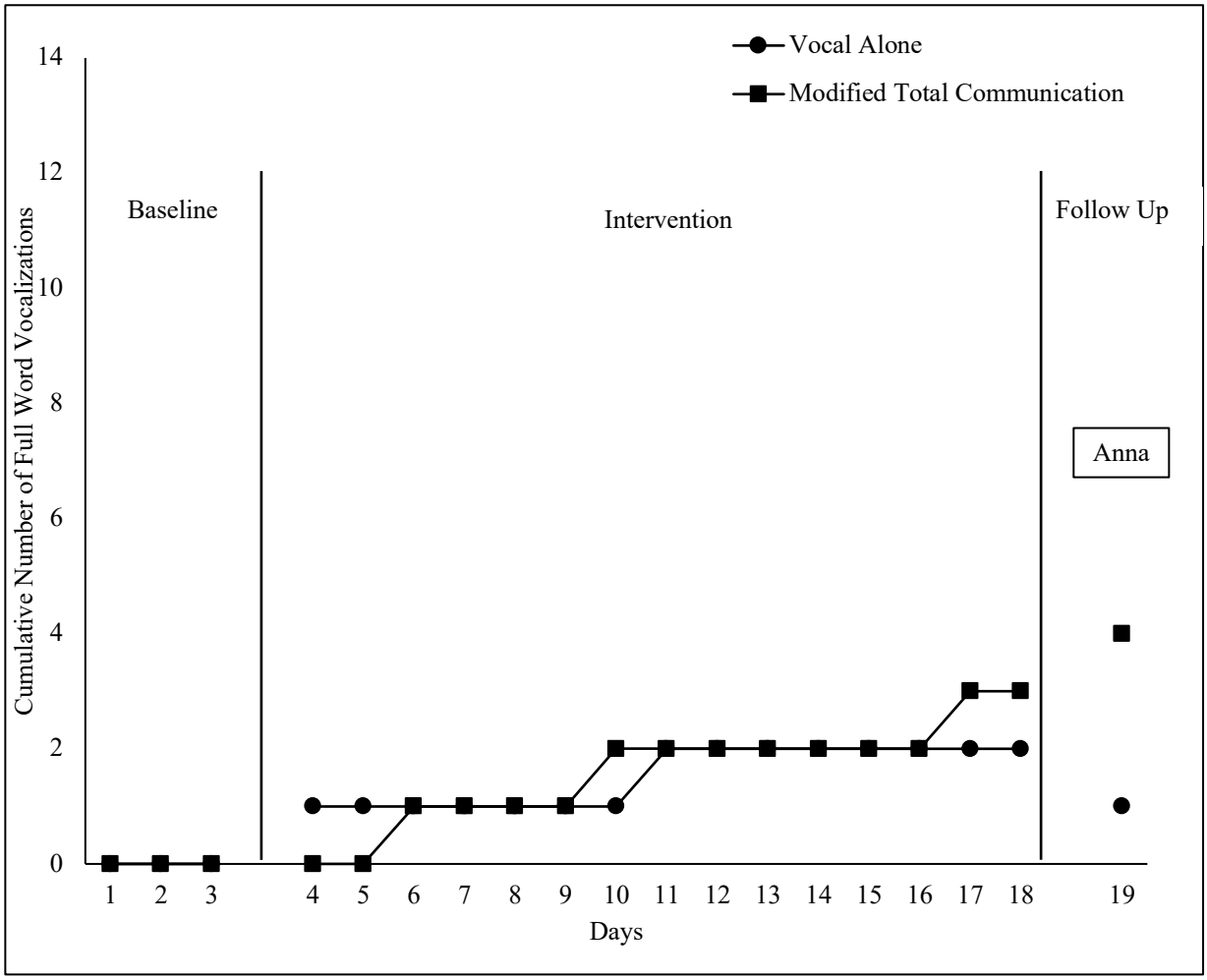

Figure 3. *Cumulative number of full word vocalizations Anna acquired in the vocal alone and modified total communication conditions.*

Figure 4 represents the mean trials to criterion Anna required to reach mastery of each full word vocalization. Anna required an average of six trials before acquiring mastery of full word vocalizations in the VA condition and an average of eight trials before acquiring mastery of target responses in the MTC condition. Anna required fewer trials in the VA condition to acquire full word vocalizations than in the MTC condition, however, she acquired mastery of fewer target responses in the VA condition.

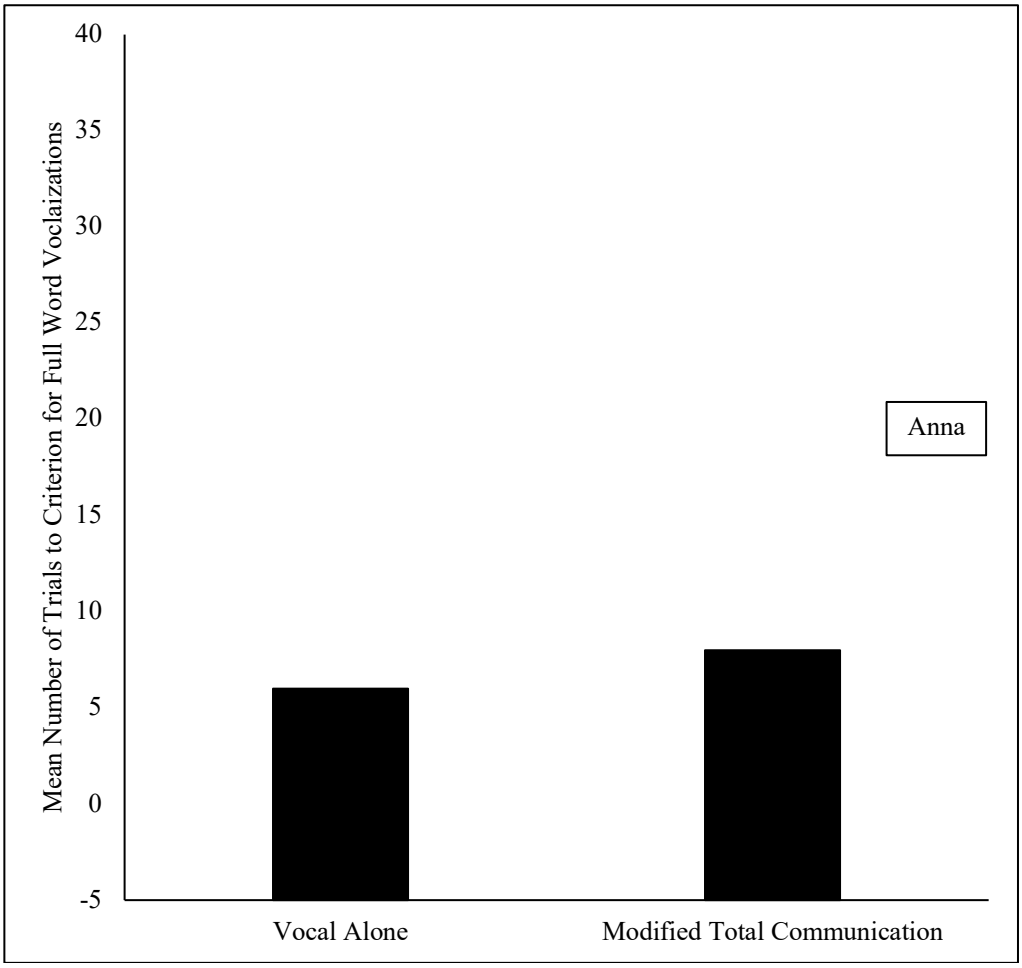

Figure 4. *Mean number of trials to criterion for mastery of full word vocalizations Anna acquired during intervention in the vocal alone and modified total communication conditions.*

Anna did not acquire mastery of any independent vocalizations in either the VA or MTC condition. She also did not acquire mastery of any sign language responses in the MTC condition. Figure 5 represents the percentage of trials in which each communicative response was emitted by Anna during intervention and follow up of the MTC condition. In the sixth, ninth, and twelfth data point sign language reached the highest rates of responding when vocal responses were also recorded at 100%. Anna almost acquired mastery of one sign language response during the twelfth intervention. During follow up, Anna emitted only one occurrence of a sign language response.

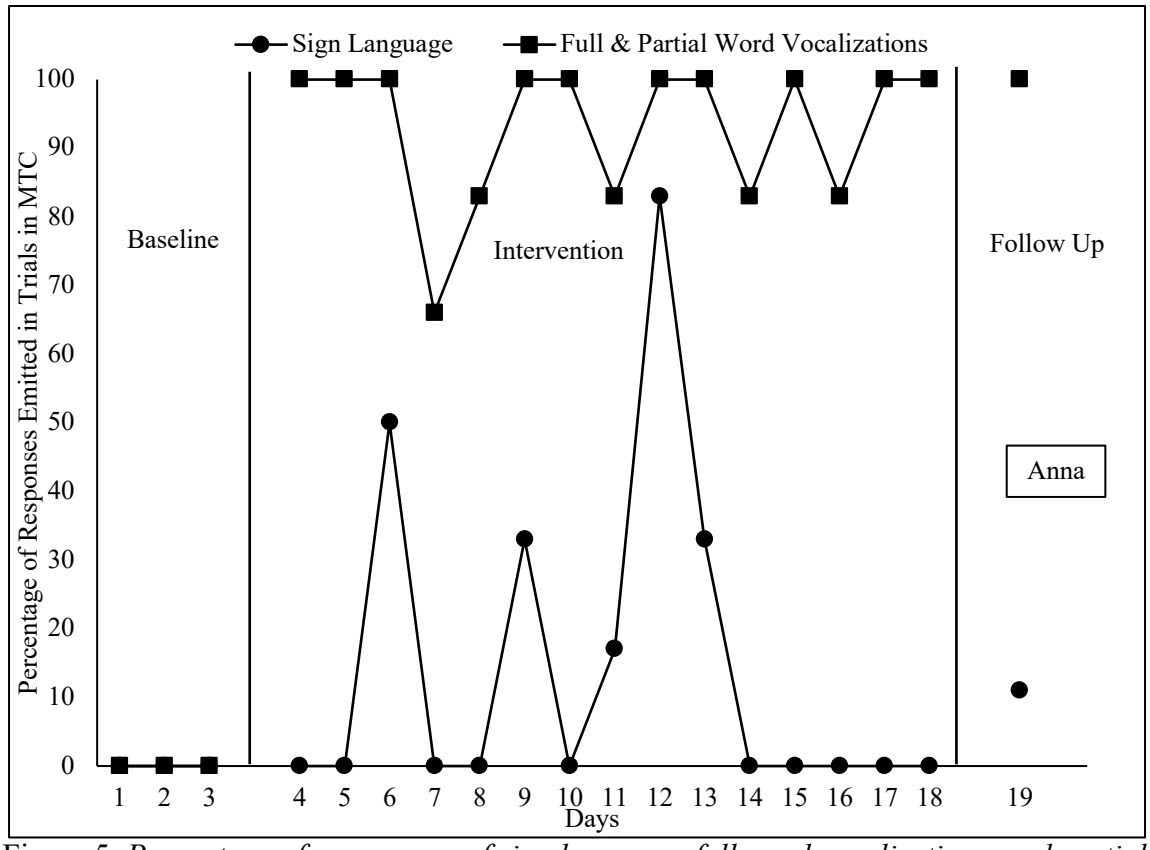

Figure 5. *Percentage of occurrence of sign language, full word vocalizations, and partial word vocalizations Anna emitted in the modified total communication condition.*

Bob. The cumulative number of full word vocalizations and partial word vocalizations Bob acquired in both the VA and MTC conditions are represented in Figure

6. Bob required six trials to meet the mastery criterion of the first vocal response presented in the MTC condition. He required 15 trials before meeting the mastery criterion of the first vocal response presented in the VA condition. The twelfth data point shows Bob had mastered five vocal responses in the VA condition and four vocal responses in the MTC condition. By the last intervention session, Bob had mastered 12 vocal responses in the VA condition and 13 vocal responses in the MTC condition. A total number of 156 trials were conducted in both the VA and MTC conditions.

The cumulative number of vocal responses Bob emitted approximately two weeks after intervention are also represented in Figure 6. Follow up was conducted over 36 trials presented in both the VA and MTC conditions. A total of six target responses were presented in each condition. Bob emitted 5/6 vocal responses in the VA condition; he emitted 6/6 vocal responses in the MTC condition.

In Figure 6 Bob emitted high rates of responding in the VA and MTC conditions with no real difference in the acquisition of vocal responses.

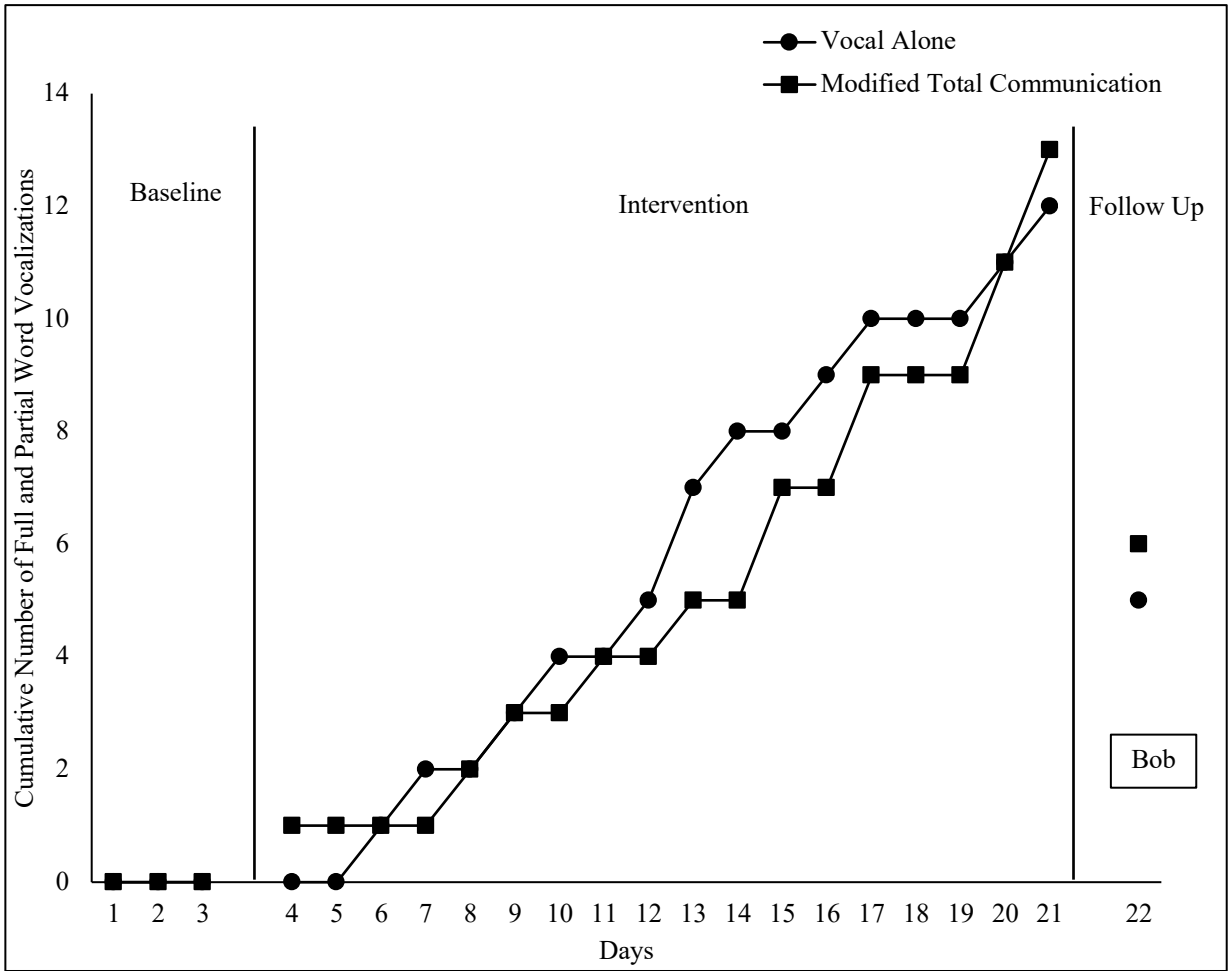

Figure 6. *Cumulative number of full word vocalizations and partial word vocalizations Bob acquired in the vocal alone and modified total communication conditions.*

Figure 7 represents the mean trials to criterion for mastery of full word vocalizations and partial word vocalizations Bob acquired in both the VA and MTC conditions during intervention. Bob required an average of 11 trials to reach mastery of vocal response in the VA condition. Bob required an average of ten trials in the MTC condition to reach mastery criterion. Bob required slightly fewer trials to acquire mastery criterion of target vocal responses in the MTC condition than in the VA condition.

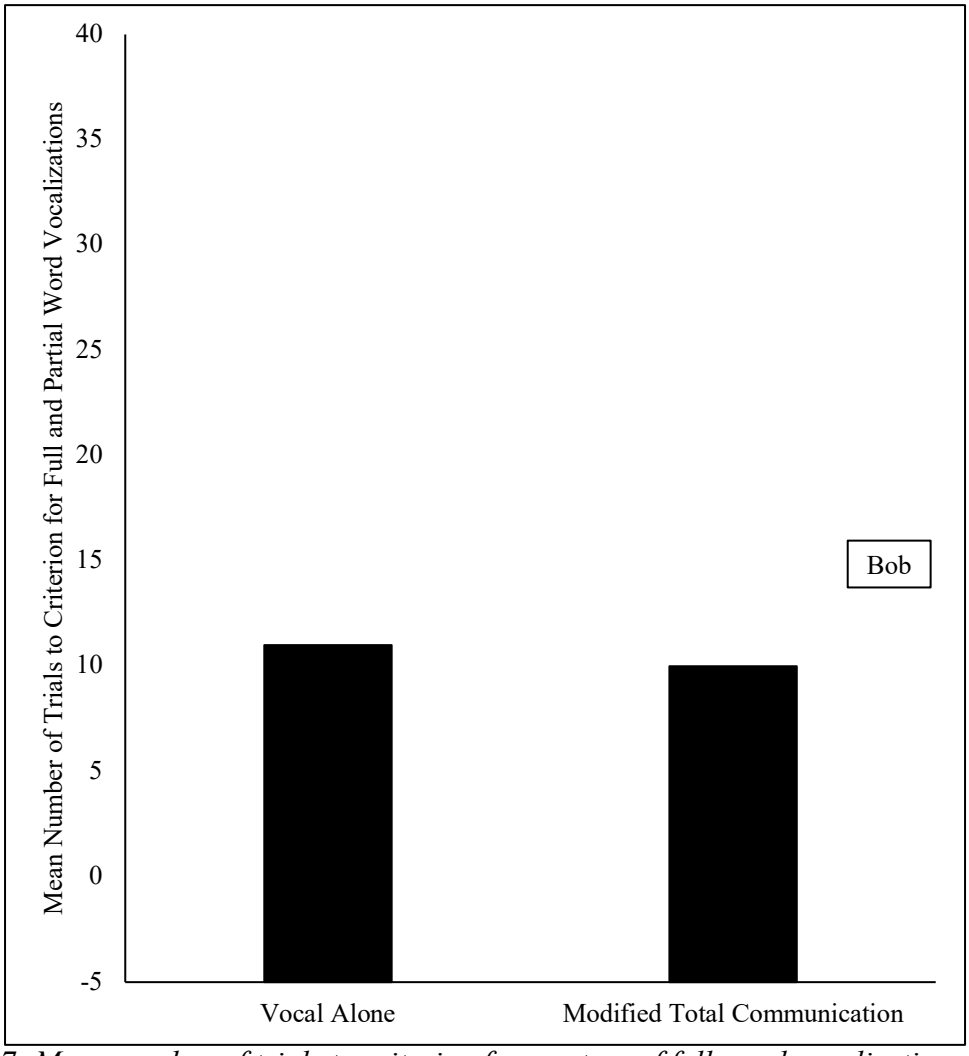

Figure 7. *Mean number of trials to criterion for mastery of full word vocalizations and partial word vocalizations Bob acquired during intervention in the vocal alone and modified total communication conditions.*

Figure 8 represents the cumulative number of full word vocalizations Bob acquired during intervention of both the VA and MTC conditions. Bob acquired his first full word vocalization in the MTC condition after six trials. He acquired his first full word vocalization in the VA condition after 15 trials. The twelfth data point shows Bob had acquired two full word vocalizations in the VA condition and in the MTC condition. By the last intervention session, Bob had acquired a total of seven full word vocalizations in the VA condition and six full word vocalizations in the MTC condition.

The cumulative number of full word vocalizations Bob emitted are also presented in Figure 8. Bob emitted five full word vocalizations presented in the VA condition; he emitted four full word vocalizations in the MTC condition.

Results of Figure 8 would suggest VA training had an advantage over MTC procedures in the acquisition of full word vocalizations.

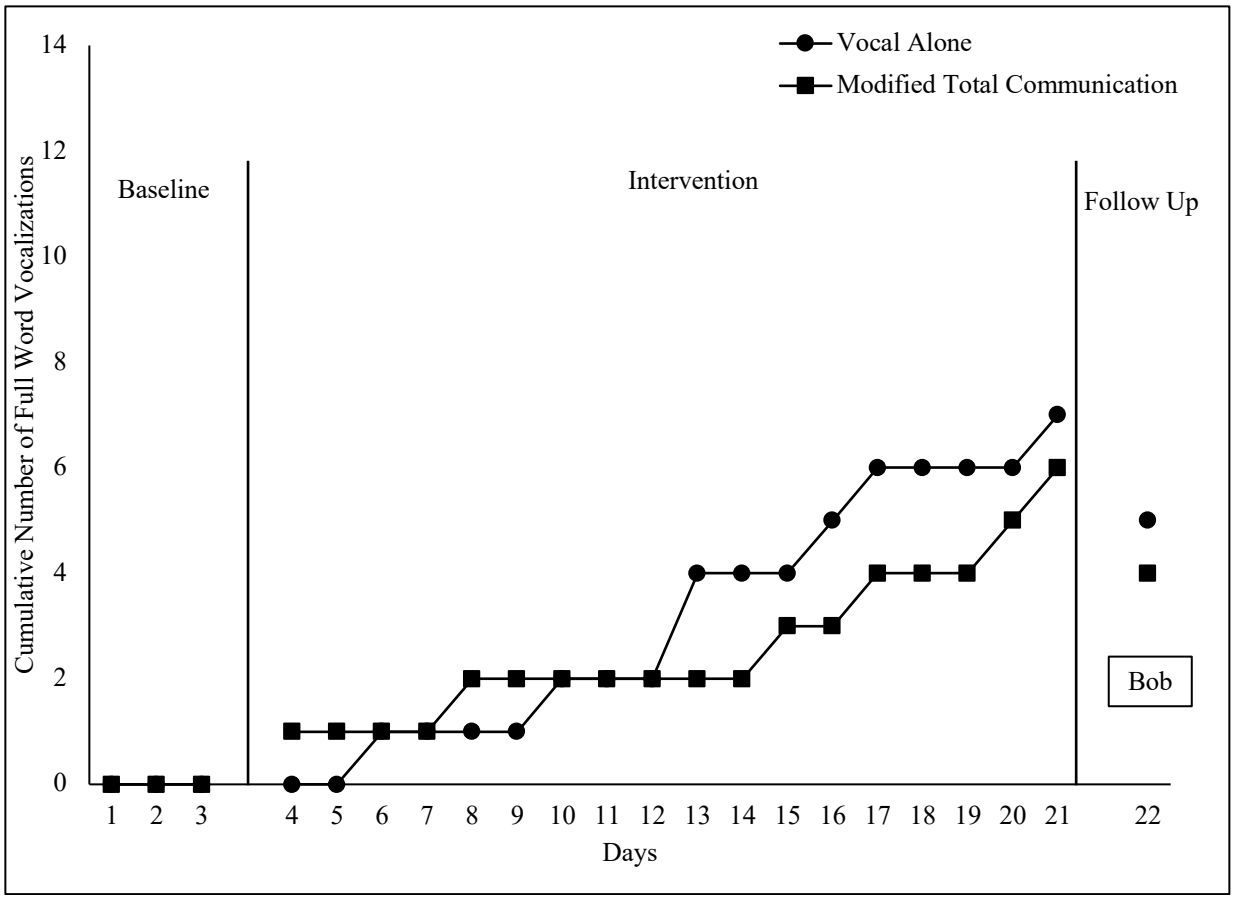

Figure 8. *Cumulative number of full word vocalizations Bob acquired in the vocal alone and modified total communication conditions.*

Figure 9 represents the mean trials to criterion Bob required to reach mastery of each full word vocalization. Bob required an average of seven trials before acquiring mastery of full word vocalizations in the VA condition and an average of eight trials

before acquiring mastery of full word vocalizations in the MTC condition. Bob required fewer trials in the VA condition to acquire mastery of full word vocalizations.

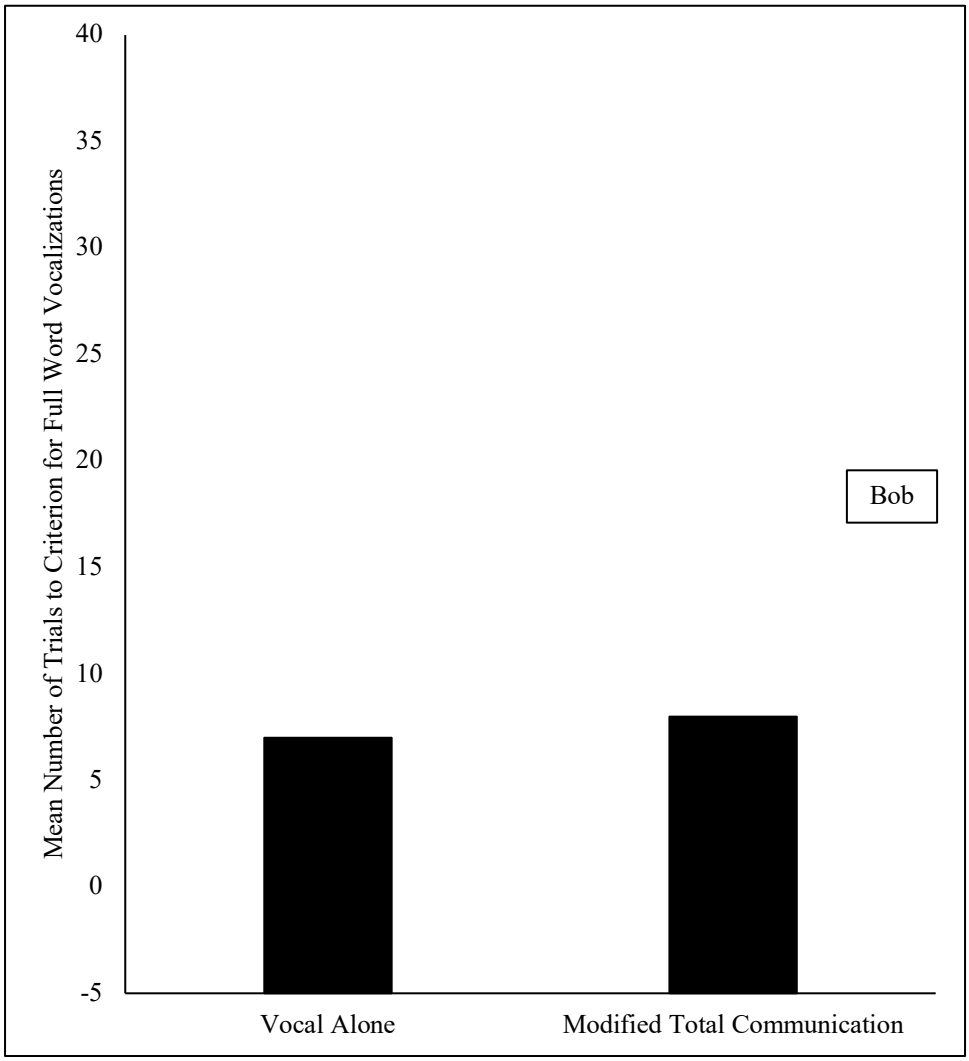

Figure 9. *Mean number of trials to criterion for mastery of full word vocalizations Bob acquired during intervention in the vocal alone and modified total communication conditions.*

Figure 10 represents the cumulative number of independent vocalizations Bob acquired during intervention of the MTC condition. During intervention, Bob did not acquire mastery of any independent vocalizations in the VA condition. Bob acquired his first independent vocalization in the MTC condition after nine trials. By the last

intervention session, Bob had acquired a total of two independent vocalizations in the MTC condition.

The cumulative number of independent vocalizations Bob emitted are also presented in Figure 10. Bob emitted three independent vocalizations in the VA condition and five independent vocalizations in the MTC condition.

A visual analysis of Figure 10 would suggest MTC procedures to have a slight advantage over VA training in the acquisition of independent vocalizations, although both interventions took time to facilitate acquisition. MTC appears to have an even greater advantage in the occurrence of independent vocalizations in the follow up phase.

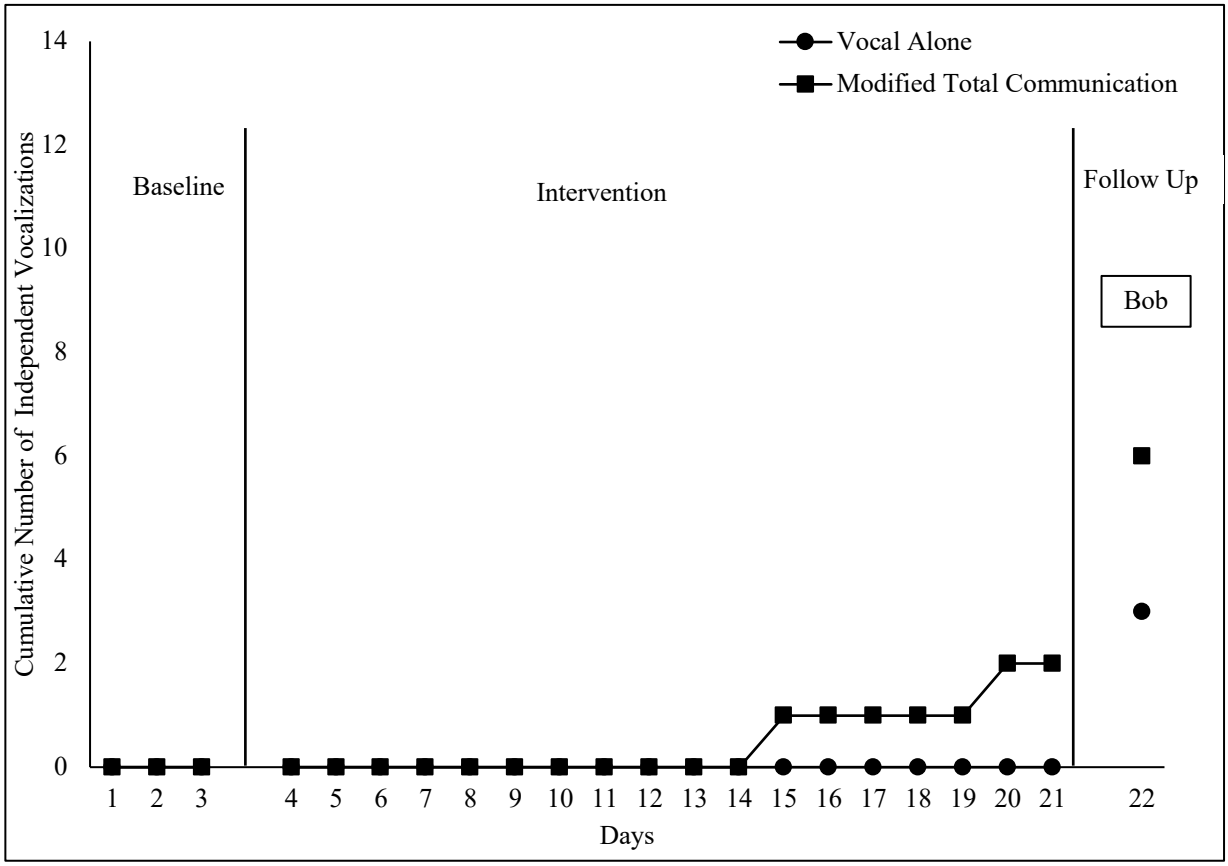

Figure 10. *Cumulative number of independent vocalizations Bob acquired in the vocal alone and modified total communication conditions.*

Figure 11 represents the mean trials to criterion Bob required to reach mastery of each independent vocalization in the MTC condition during intervention. Bob required an average of nine trials to acquire mastery of two independent vocalizations in the MTC condition. Bob did not reach mastery criterion of any independent vocalizations in the VA condition during intervention.

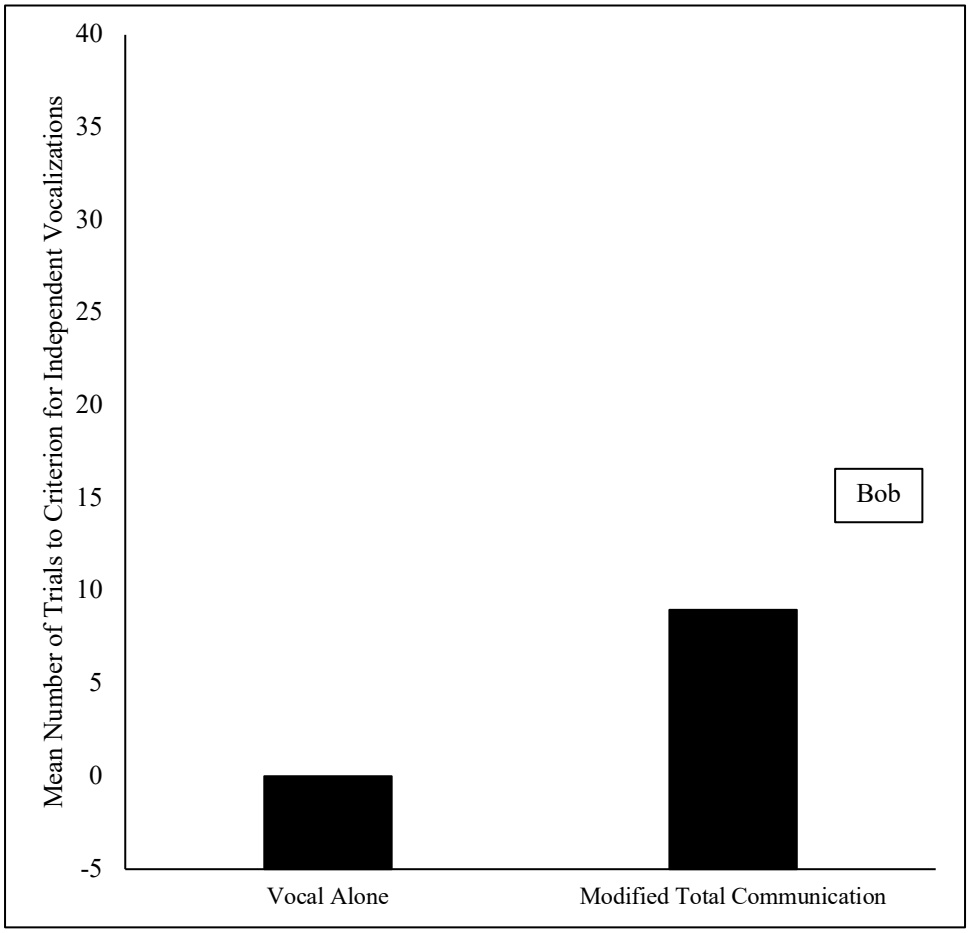

Figure 11. *Mean number of trials to criterion for mastery of independent vocalizations Bob acquired during intervention in the vocal alone and modified total communication conditions.*

Bob did not acquire mastery of any sign language responses in the MTC condition. Figure 12 represents the percentage of trials in which each communicative response was emitted by Bob during intervention and follow up of the MTC condition. Bob emitted one occurrence of a sign language response during intervention. This was

the only occurrence of sign language emitted by Bob throughout intervention and follow up of the MTC condition.

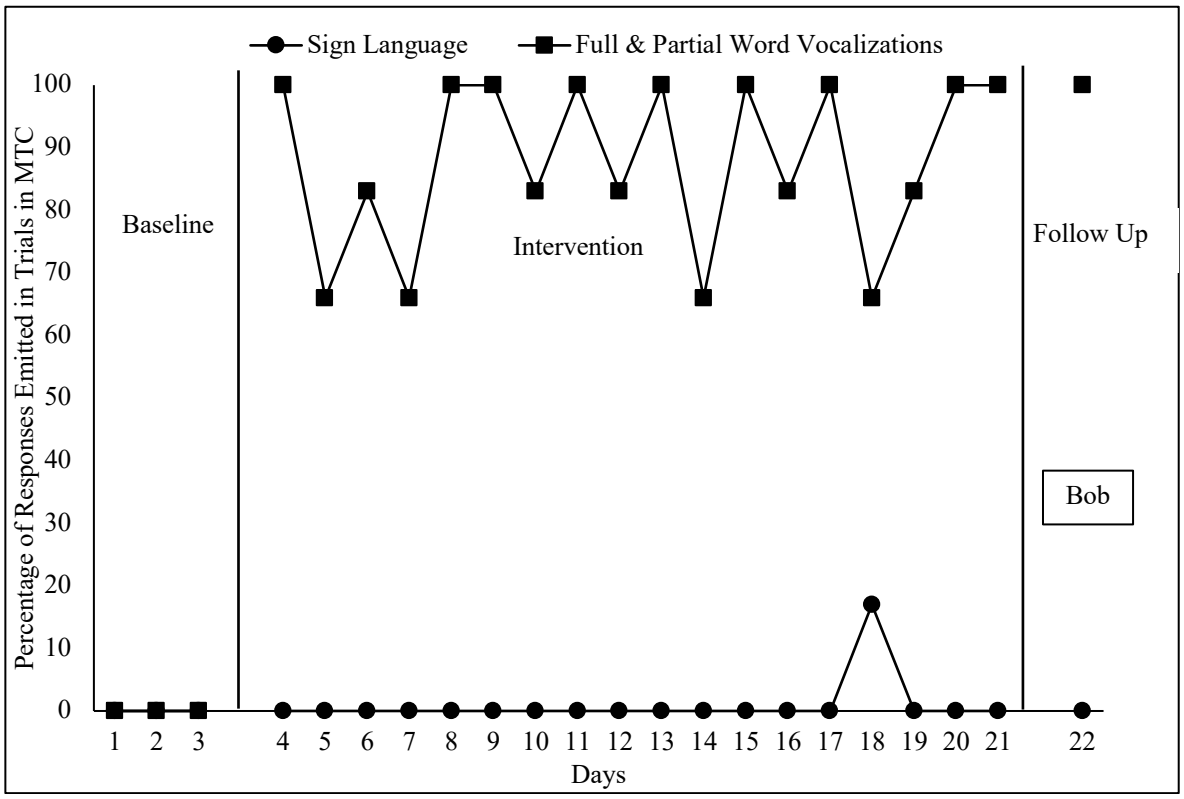

Figure 12. *Percentage of occurrence of sign language, full word vocalizations, and partial word vocalizations Bob emitted in the modified total communication condition.*

Dave. The cumulative number of full word vocalizations and partial word vocalizations Dave acquired in both the VA and MTC conditions are represented in Figure 13 below. Dave required six trials to meet the mastery criterion of the first vocal response presented in both the VA and MTC conditions. The 11th data point shows Dave had mastered two vocal responses in the VA and MTC conditions. By the last intervention session, Dave had mastered a total of two vocal responses in the VA condition and five vocal responses in the MTC condition. A total of 96 trials were conducted in both the VA and MTC conditions.

The cumulative number of vocal responses Dave emitted approximately two weeks after intervention are also represented in Figure 13. Follow up was conducted over 24 trials presented in both the VA and MTC conditions. A total of four target responses were presented in each condition. Dave emitted 1/4 vocal response in the MTC condition; he did not emit any vocal responses in the VA condition.

Results of Figure 13 would suggest MTC training had a slight advantage over VA procedures in the acquisition of vocal responses.

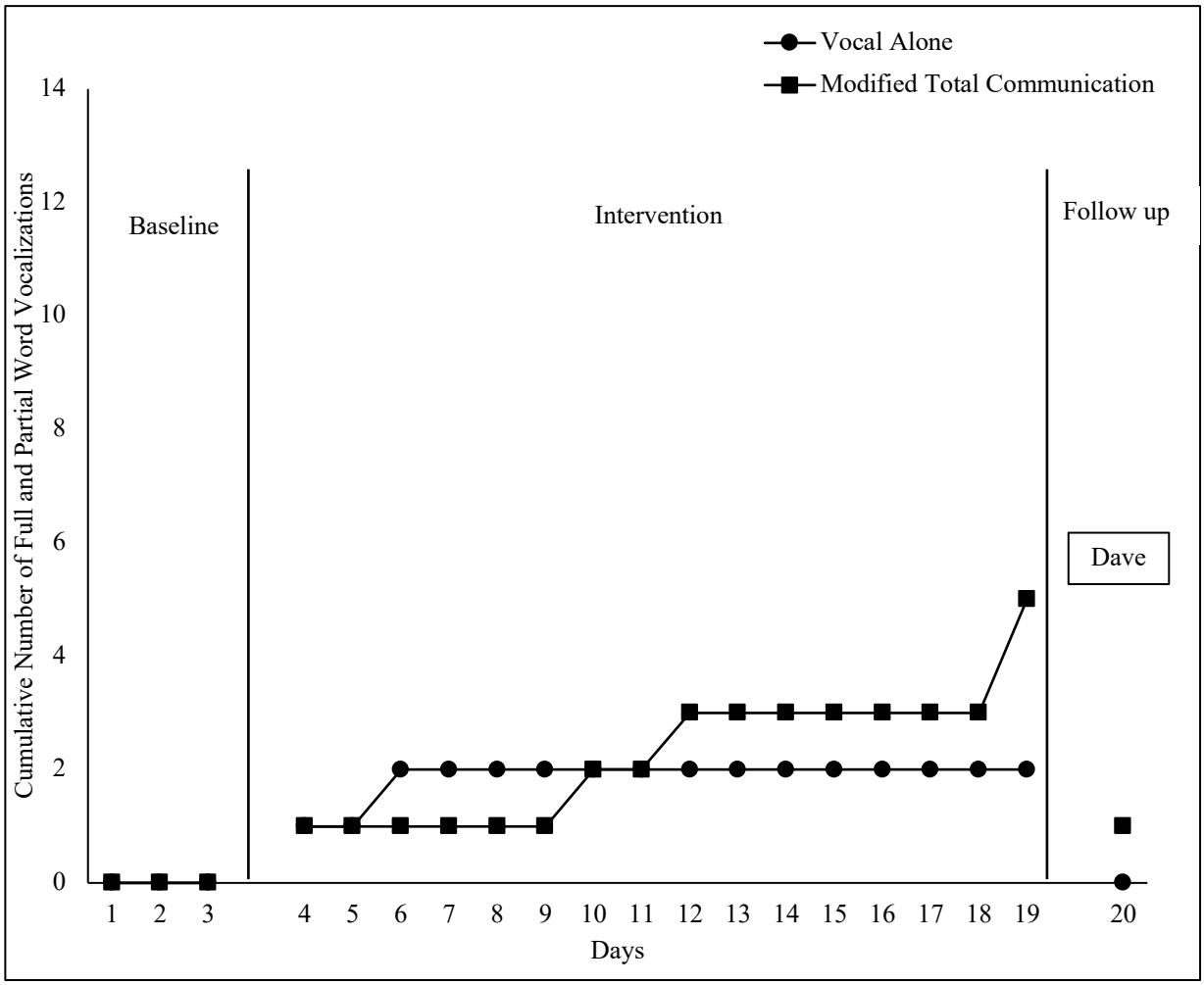

Figure 13. *Cumulative number of full word vocalizations and partial word vocalizations Dave acquired in the vocal alone and modified total communication conditions.*

Figure 14 represents the mean trials to criterion for mastery of full word vocalizations and partial word vocalizations Dave acquired in both the VA and MTC conditions during intervention. Dave required an average of 21 trials to reach mastery of vocal responses in the VA condition. Dave required an average of 17 trials in the MTC condition to reach mastery criterion. Dave required fewer trials to acquire mastery criterion of target responses in the MTC condition. Dave also acquired three more vocal responses in the MTC condition than in the VA condition.

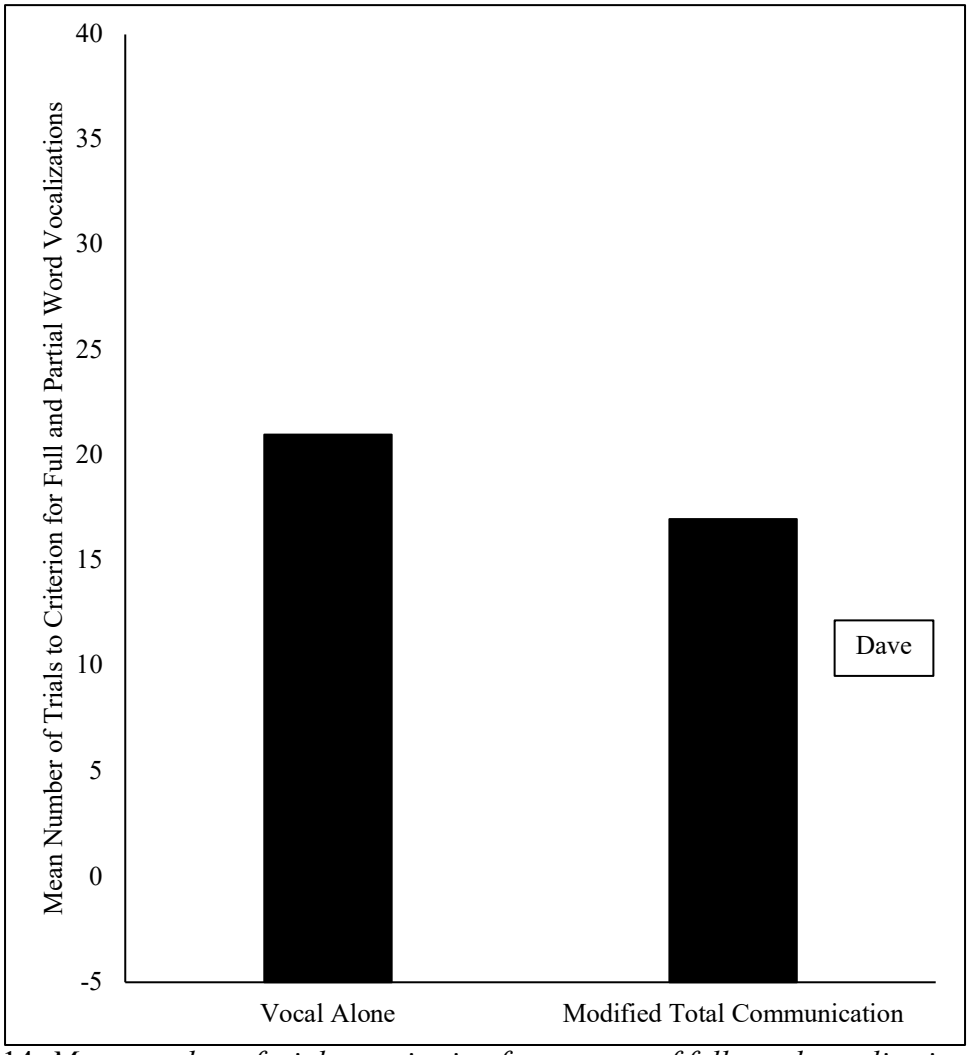

Figure 14. *Mean number of trials to criterion for mastery of full word vocalizations and partial word vocalizations Dave acquired during intervention in the vocal alone and modified total communication conditions.*

Figure 15 represents the cumulative number of full word vocalizations Dave acquired during intervention of both the VA and MTC conditions. Dave acquired his first full word vocalizations in the VA condition after six trials. He acquired his first full word vocalization in the MTC condition after 36 trials. The twelfth data point shows Dave had acquired one full word vocalization in both the VA and MTC conditions. By the last intervention session, Dave had acquired a total of one full word vocalizations in the VA condition and three full word vocalizations in the MTC condition.

The cumulative number of full word vocalizations Dave emitted are represented in Figure 15. Dave did not emit any full word vocalizations in either the VA or MTC condition. There is no clear advantage found in Figure 15 on the acquisition of full word vocalizations in the VA or MTC condition, because few full words were acquired overall.

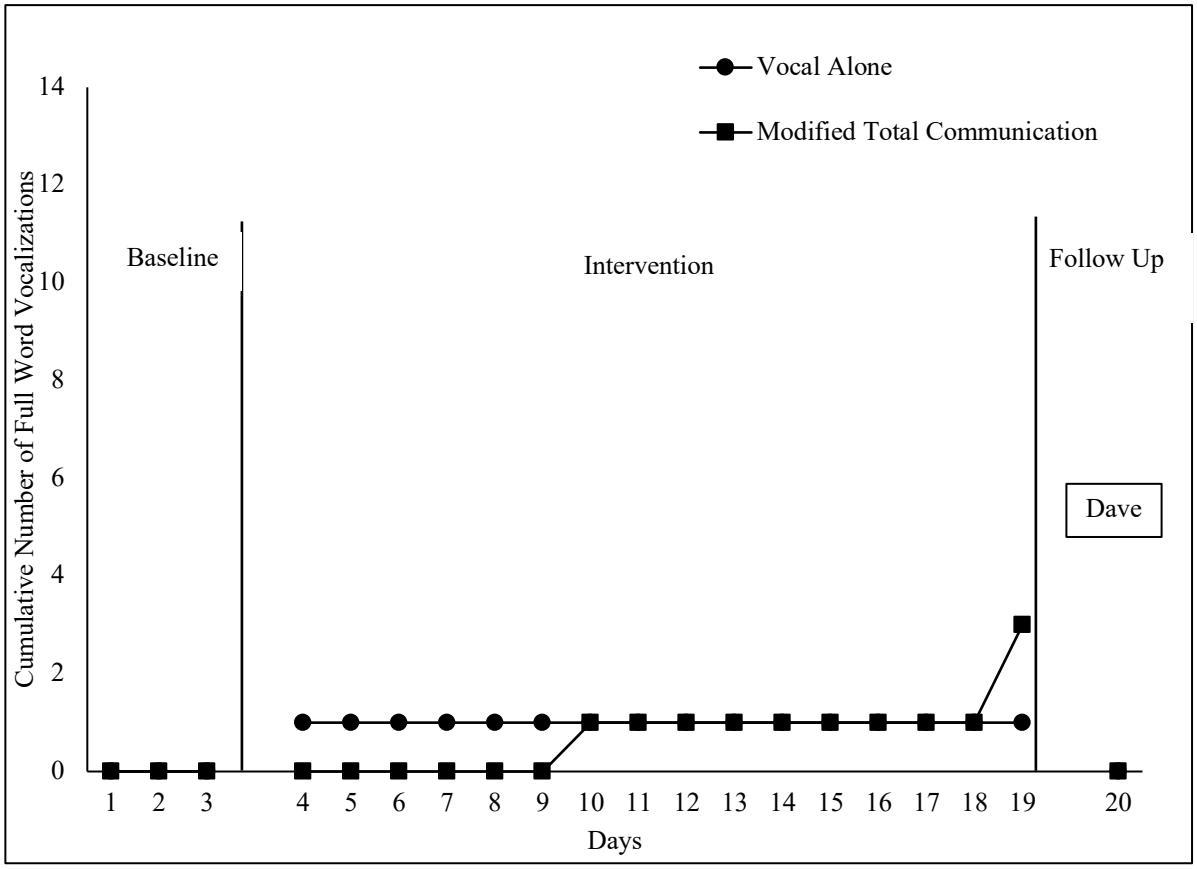

Figure 15. *Cumulative number of full word vocalizations Dave acquired in the vocal alone and modified total communication conditions.*

Figure 16 represents the mean trials to criterion Dave required to reach mastery of each full word vocalization during intervention. Dave required an average of six trials before acquiring mastery of one full word vocalization in the VA condition and an average of 22 trials before acquiring mastery of full word vocalizations in the MTC condition. Dave required fewer trials in the VA condition than in the MTC condition to acquire mastery of full word vocalizations, however, Dave acquired two more full word vocalizations in the MTC condition than in the VA condition.

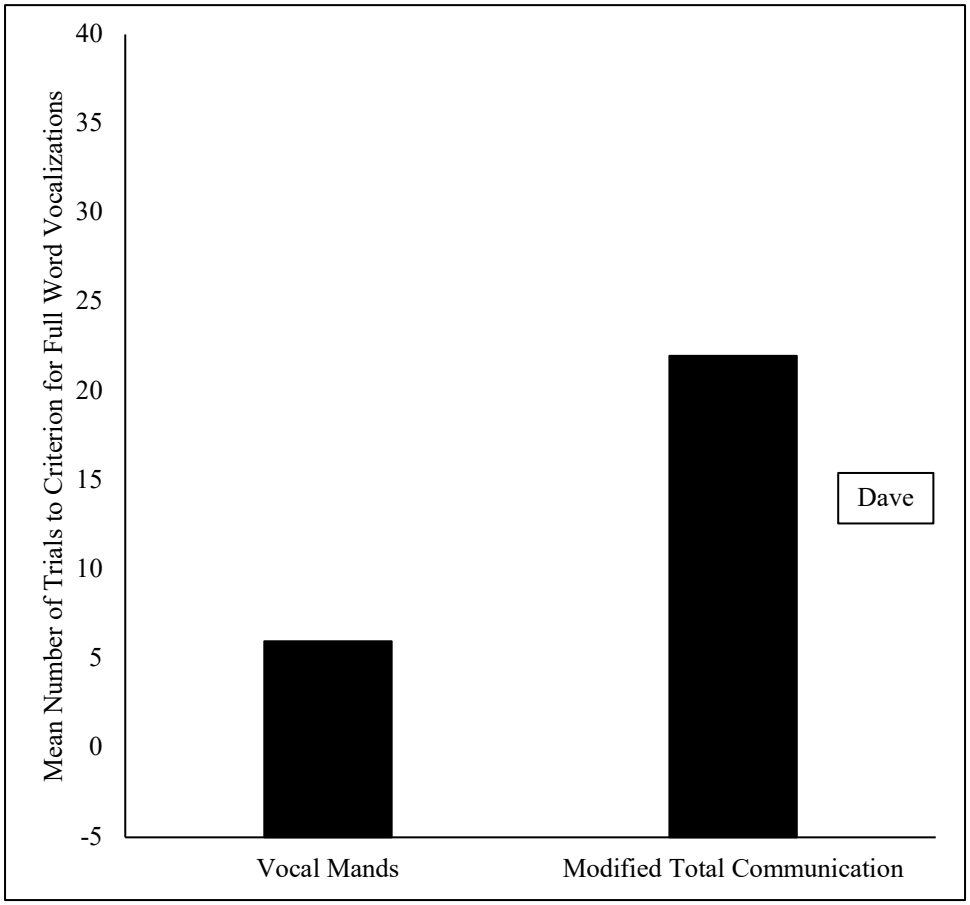

Figure 16. *Mean number of trials to criterion for mastery of full word vocalizations Dave acquired during intervention in the vocal alone and modified total communication conditions.*

Dave did not acquire mastery of any independent vocalizations in either the VA or MTC condition. He also did not meet mastery criterion of any sign language responses in the MTC condition. Figure 17 represents the percentage of trials in which each communicative response was emitted by Dave during intervention and follow up of the MTC condition. No clear relations are observed between sign language and vocal responding. Dave emitted a total of 12 sign language responses throughout the intervention. The occurrence of sign language responding was not observed during follow up of the MTC condition.

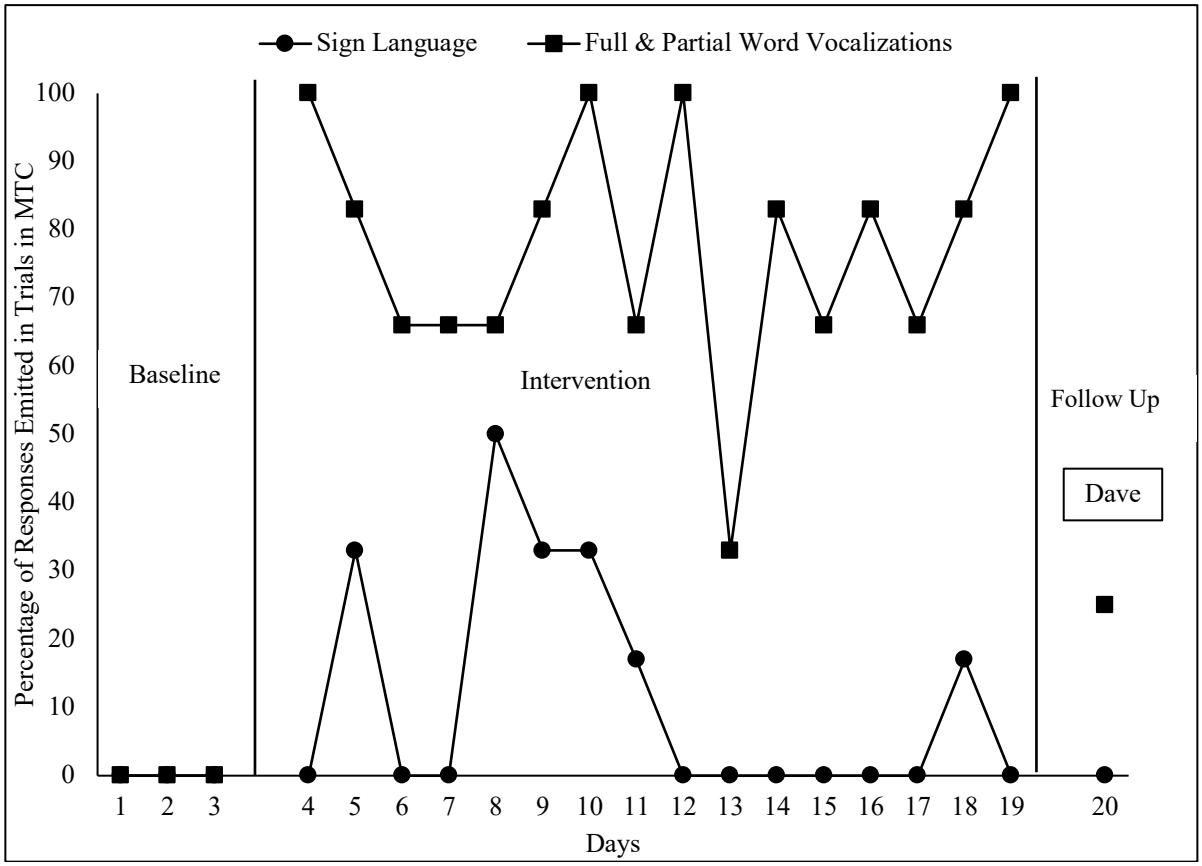

Figure 17. *Percentage of occurrence of sign language, full word vocalizations, and partial word vocalizations Dave emitted in the modified total communication condition.*

Laura. The cumulative number of full word vocalizations and partial word vocalizations Laura acquired in both the VA and MTC conditions are represented in Figure 18. Laura required 60 trials to meet the mastery criterion of the first vocal response in the MTC condition. Laura did not meet mastery criterion for any vocal response in the VA condition. The 15th data point shows Laura had mastered two vocal responses in the MTC condition. By the last intervention session, Laura had mastered a total of two vocal responses in the MTC condition. A total number of 108 trials were conducted in both the VA and MTC conditions.

The cumulative number of vocal responses Laura emitted approximately two weeks after intervention are also represented in Figure 18. Follow up was conducted over

24 trials presented in both the VA and MTC conditions. A total of four target responses were presented in each condition. Laura emitted 2/4 vocal responses presented in the MTC condition. She did not emit any vocal responses in the VA condition.

Results of the visual analysis of Figure 18 display low rates of vocal responding in the VA and MTC conditions. However, a slight advantage could be observed in the MTC condition in the acquisition of vocal responses in the intervention and follow up phase.

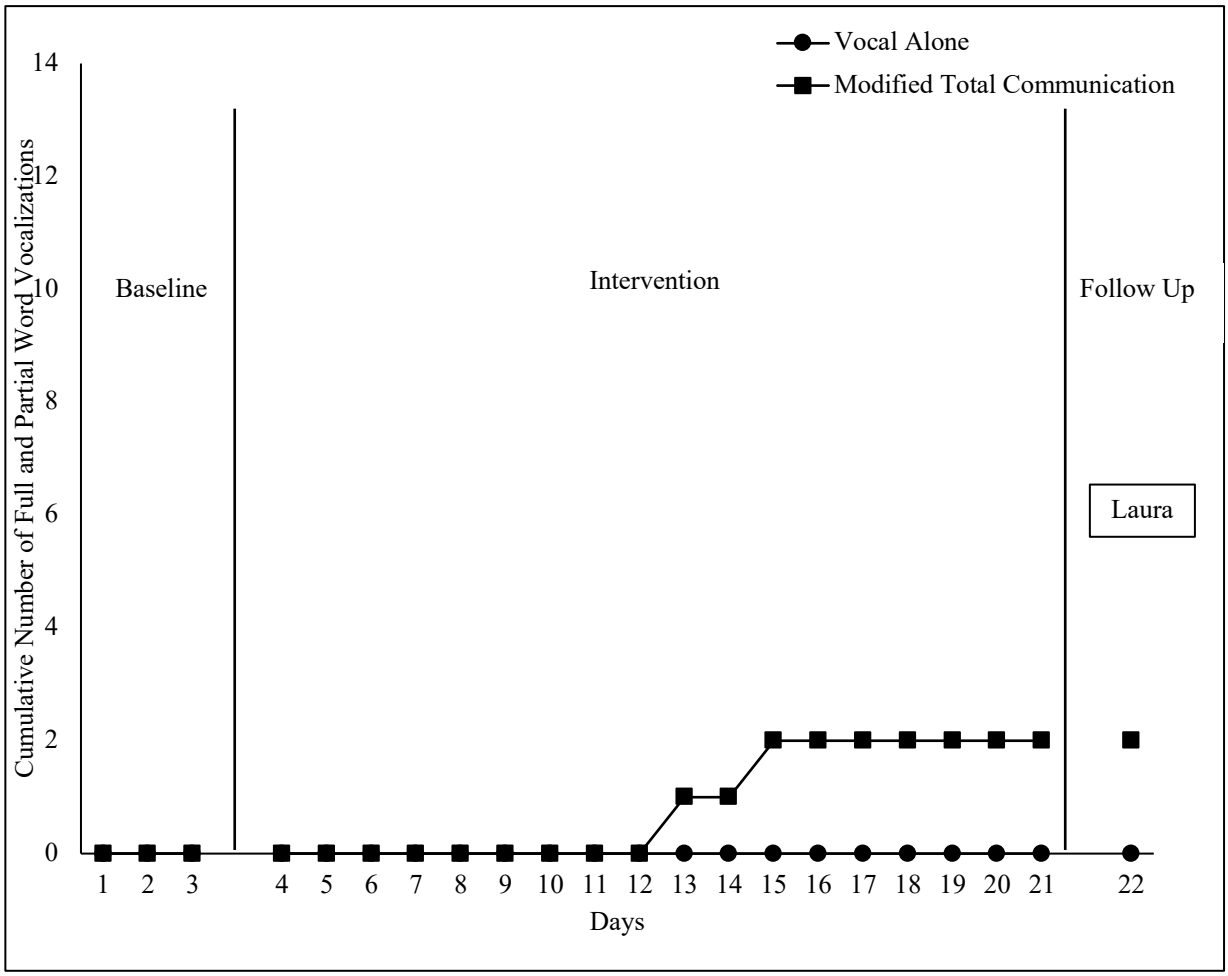

Figure 18. *Cumulative number of full word vocalizations and partial word vocalizations Laura acquired in the vocal alone and modified total communication conditions.*

Figure 19 represents the mean trials to criterion for mastery of full word vocalizations and partial word vocalizations Laura acquired in the MTC condition during intervention. Laura required an average of 36 trials to reach mastery of target vocal responses.

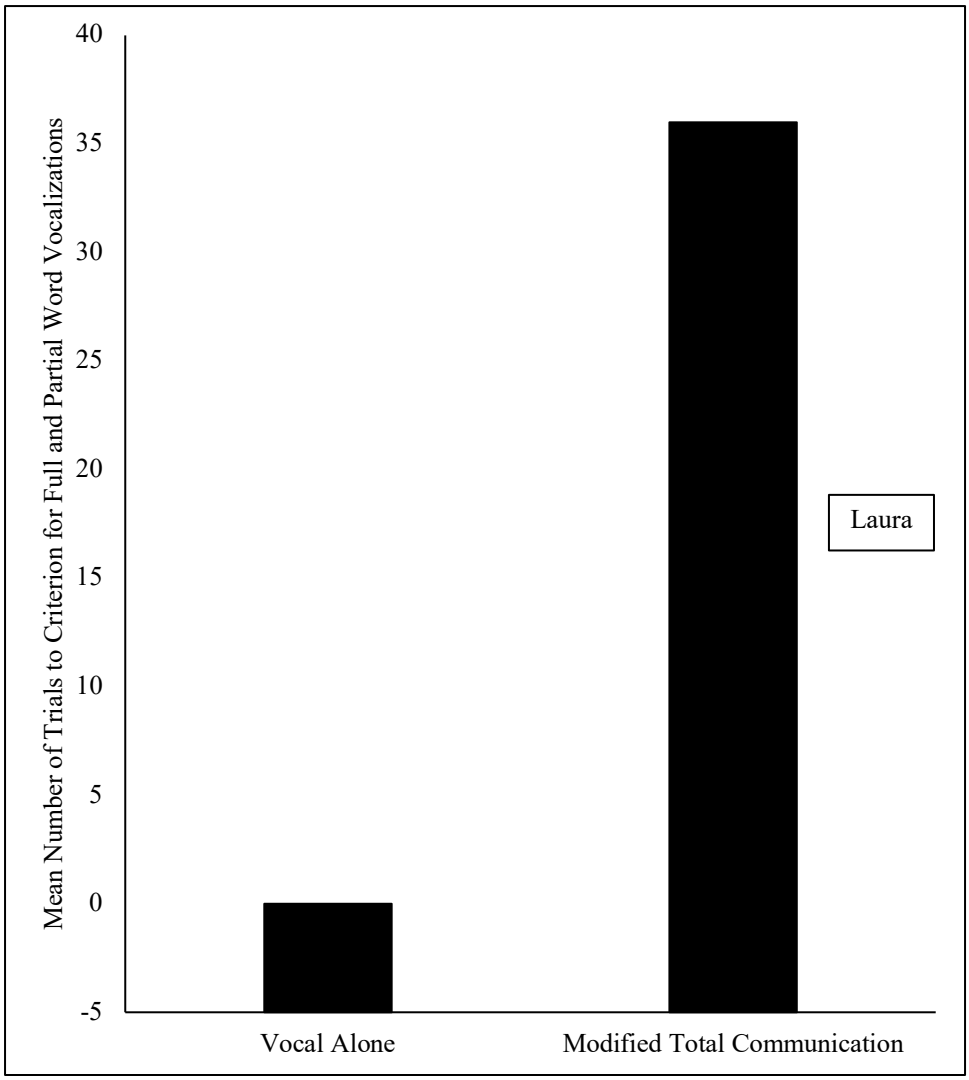

Figure 19. *Mean number of trials to criterion for mastery of full word vocalizations and partial word vocalizations Laura acquired during intervention in the vocal alone and modified total communication condition.*

Figure 20 represents the cumulative number of full word vocalizations Laura acquired during intervention in both the VA and MTC conditions. Laura acquired her

only full word vocalization in the MTC condition after 12 trials. Laura did not acquire any full word vocalizations in the VA condition. By the last intervention session, Laura had acquired only one full word vocalization in the MTC condition.

The cumulative number of full word vocalizations Laura emitted are also represented in Figure 20. Laura emitted one full word vocalization in the MTC condition; she did not emit any full word vocalizations in the VA condition.

A visual analysis of Figure 20 shows little-to-no responding in the VA and MTC conditions. However, for at least one response, MTC training appeared to have an advantage over VA procedures in the acquisition of full word vocalizations.

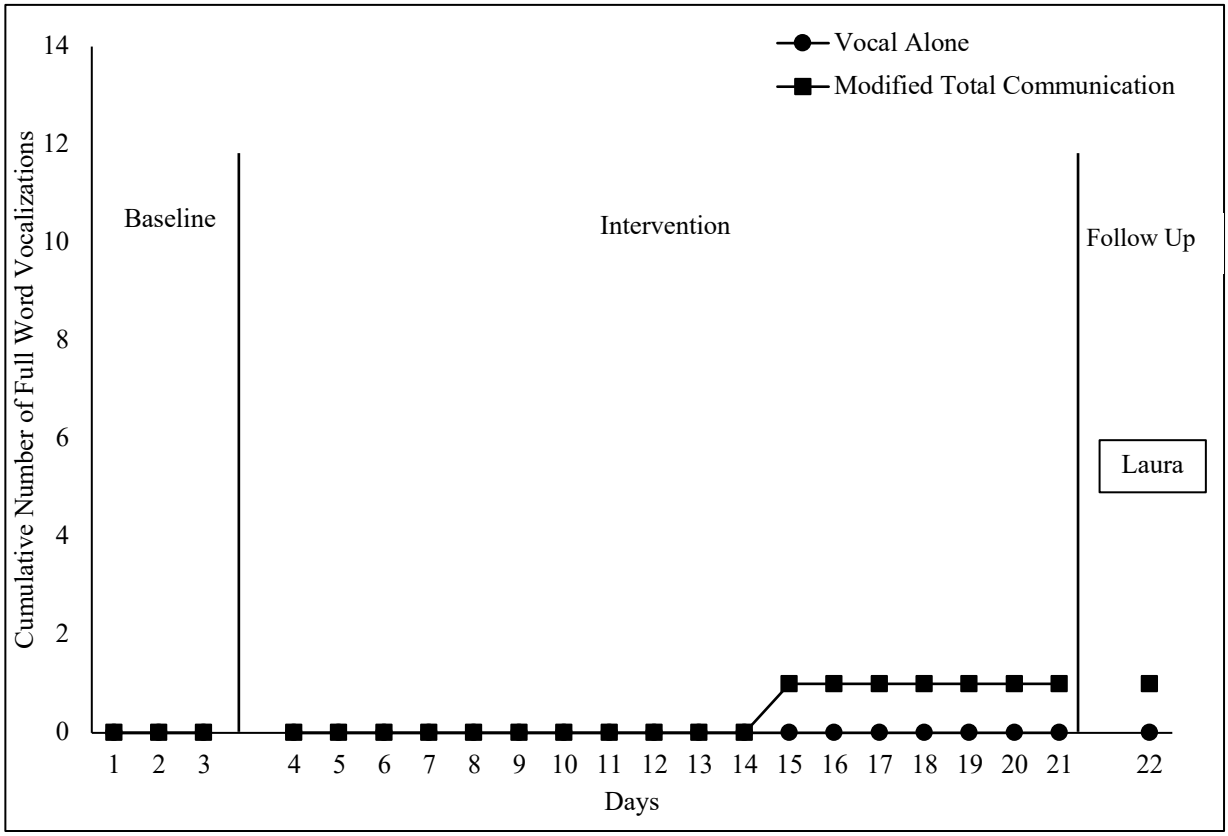

Figure 20. *Cumulative number of full word vocalizations Laura acquired in the vocal alone and modified total communication conditions.*

Figure 21 represents the mean trials to criterion Laura required to reach mastery of one full word vocalization during intervention of the MTC condition. Laura required an average of 12 trials before acquiring mastery of one full word vocalization in the MTC condition.

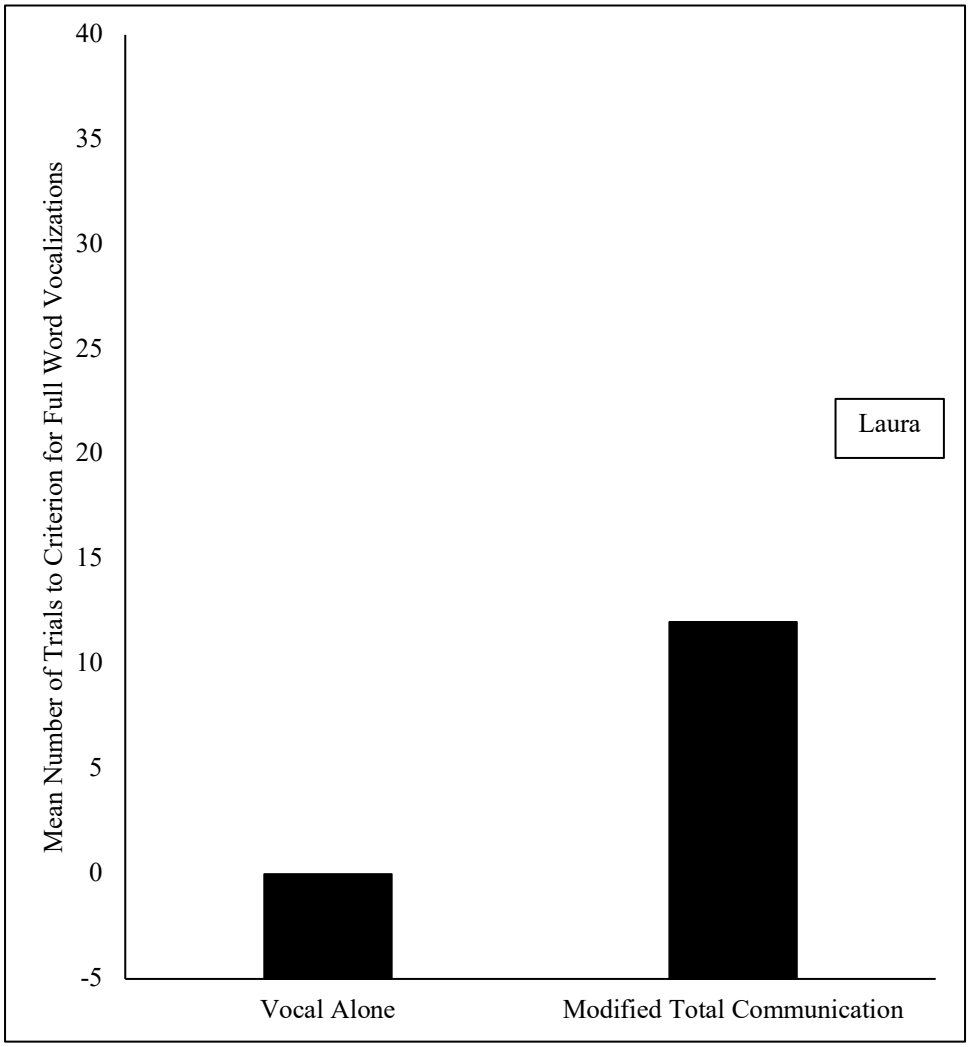

Figure 21. *Mean number of trials to criterion for mastery of full word vocalizations Laura acquired during intervention in the vocal alone and modified total communication condition.*

Figure 22 represents the cumulative number of independent vocalizations Laura acquired during intervention of the VA and MTC conditions. Laura acquired her only

independent vocalization in the MTC condition after 12 trials. Laura did not acquire mastery of any independent vocalization in the VA condition. During the last intervention session, Laura had acquired only one independent vocalization in the MTC condition.

The cumulative number of independent vocalizations Laura emitted are presented in Figure 22. Laura emitted one independent vocalizations in the MTC condition; she did not emit any independent vocalizations in the VA condition during the follow up phase.

A visual analysis of Figure 22 shows little-to-no responding in the VA and MTC condition. However, for at least one response, MTC training appeared to have an advantage over VA procedures in the acquisition of independent vocalizations.

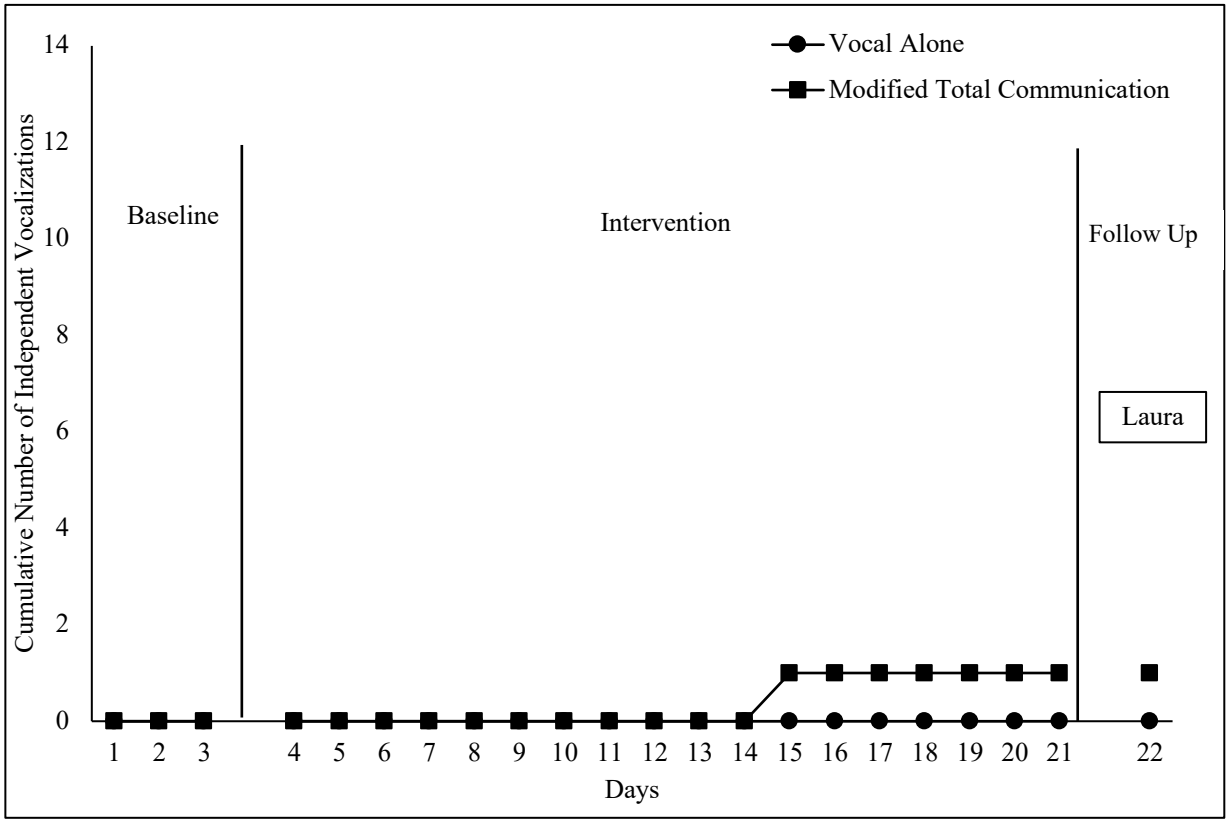

Figure 22. *Cumulative number of independent vocalizations Laura acquired in the vocal alone and modified total communication conditions.*

Figure 23 represents the mean trials to criterion Laura required to reach mastery of the independent vocalization in the MTC condition during intervention. Laura required an average of 12 trials to acquire mastery of one independent vocalizations in the MTC condition. Laura did not reach mastery criterion of any independent vocalizations in the VA condition.

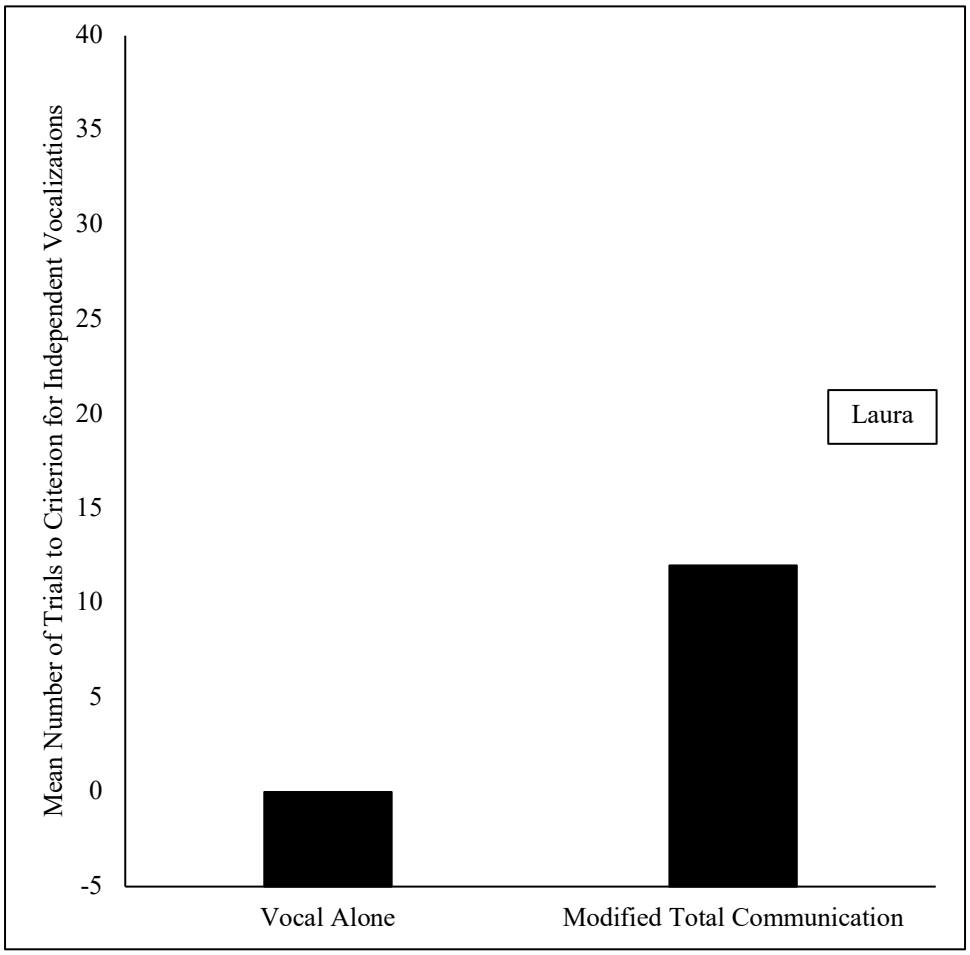

Figure 23. *Mean number of trials to criterion for mastery of independent vocalizations Laura acquired during intervention in the vocal alone and modified total communication condition.*

Laura did not acquire mastery of any sign language responses in the MTC condition. Figure 24 represents the percentage of trials in which each communicative response was emitted by Laura during intervention and follow up of the MTC condition.

Laura emitted a total of six sign language responses throughout intervention. The occurrence of sign language responding was not observed during follow up of the MTC condition. In the eighth and ninth data point, a gradual increase in responding is observed in the occurrence of both vocal and sign language responses.

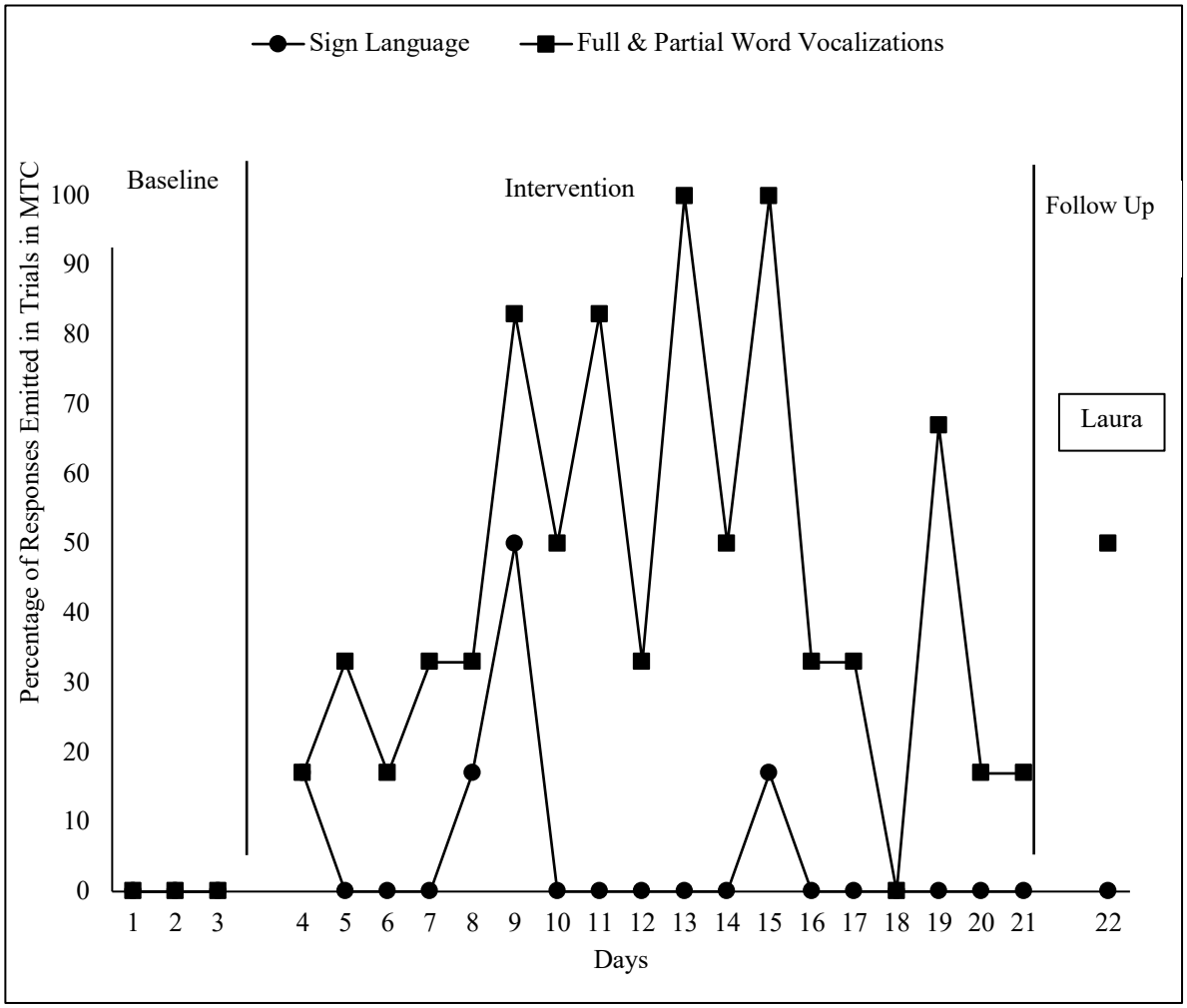

Figure 24. *Percentage of occurrence of sign language, full word vocalizations, and partial word vocalizations Laura emitted in the modified total communication condition.*

Social Validity

Prior to intervention, the participants' parents were assessed to determine the social acceptability of this intervention. Every parent responded that their understanding

of the study was ‘very’ clear, and that they felt ‘very’ comfortable contacting the researcher. Every parent also indicated that they were ‘very’ comfortable with their child learning sign language. All but one parent indicated they were ‘very’ interested in the proposed intervention and thought that participation in this research would be ‘very’ beneficial to their child. Anna’s mother indicated she was in between ‘somewhat’ and ‘very’ interested in the proposed intervention. Anna’s mother also noted between ‘somewhat’ and ‘very’ when asked if she thought the intervention would be beneficial for her child.

The majority of the parents were ‘very’ interested in learning sign language and implementing sign language training after the intervention. Anna’s mother again scored in between ‘somewhat’ and ‘very’ interested in learning sign language and implementing training after the intervention. When asked if they thought their routine would be disrupted or their child would experience discomfort by participating in this intervention, every parent indicated ‘not at all’.

After all experimental conditions had concluded the participants’ parents completed a similar questionnaire to assess the social importance of this intervention. Every parent indicated their understanding of the results were ‘very’ clear. Two parents (Bob and Laura) found the intervention to be ‘very’ beneficial, while the other two parents (Anna and Dave) found it to be ‘somewhat’ beneficial. Two parents (Dave and Laura) indicated that they ‘very’ much noticed an increase in their child’s vocal responding. Anna’s mother scored in between ‘somewhat’ and ‘very’ when asked if she noticed an increase in Anna’s vocal responses. Dave’s mother indicated that she ‘somewhat’ noticed an increase in his vocal responses.

Every parent indicated that they ‘very’ much liked the study and that they would ‘definitely’ recommend this intervention to another parent. All but one parent indicated they were ‘very’ interested in implementing this intervention at the conclusion of this research. Anna’s mother indicated that she was ‘somewhat’ interested in implementing this intervention. When asked if their child experienced discomfort or they noticed their routine to be disrupted, every parent indicated ‘not at all.’ When asked how well carrying out these procedures would fit into their daily routines, every parent indicated ‘very’ well. Social validity results for all participants averaged 96% (range: 89% - 100%) for both before and after intervention.

CHAPTER 4

DISCUSSION

Research Question 1

The first research question sought to find the differential effects of vocal alone (VA) and modified total communication (MTC) procedures on the acquisition of vocal mands (i.e., full word vocalizations and partial word vocalizations) in children with ASD. The results of this study suggest MTC training to have a slight advantage in the acquisition of vocal responses in children diagnosed with ASD for three participants (Anna, Dave, Laura). MTC also appeared to have a slight advantage in the acquisition of full word vocalizations for at least two participants (Anna, Laura). A visual analysis determined a minimal advantage in the MTC condition in the acquisition of independent vocalizations for two participants (Bob, Laura).

Anna acquired two more vocal responses in the MTC condition than in the VA condition. She also required fewer trials to criterion in the MTC condition. Anna's high rates of acquisition in both conditions can be attributed to her strong vocal imitation skills measured on the VB-MAPP prior to intervention. Anna scored a 4.5 on the Mand section of the VB-MAPP. No clear advantages were observed in the acquisition of vocal responses Bob acquired throughout intervention.

Bob's high rates of responding in both the VA and MTC conditions can also be explained by his strong vocal imitation skills prior to intervention. Bob scored a 3.5 on the Mand section of the VB-MAPP. A slight advantage can be observed for Dave in the acquisition of vocal responses in the MTC condition. Dave acquired five vocal responses in the MTC condition and only two in the VA condition, he also required less trials to criterion.

Laura produced the least amount of responding in both the VA and MTC conditions compared to the other participants. Laura was the only participant that did not have prior exposure to discrete trial teaching. She also had recently started preschool for the first time; three months prior to intervention. Laura's lack of exposure to intensive teaching and an educational environment may explain her lack of responding. However, a slight advantage can be found in the MTC condition for Laura, who acquired two vocal responses in the MTC condition. She did not meet mastery criterion for any vocal responses in the VA condition.

The topography of most sign language responses consisted of slight manipulation of the hands and fingers. For example, the sign language response for sand is completed by rubbing your thumbs against your fingers as if you're feeling sand. The sign for 'go' is completed by throwing both forward and tracing an arc shape in the air. Some responses could be said to be more difficult for individuals with weaker fine motor imitation skills. However, many responses could be completed with 1-2 quick motions of the hands and fingers.

Research Question 2

The second research question sought to determine the differential effects of vocal alone (VA) and modified total communication (MTC) procedures on vocal mands (i.e., full word vocalizations and partial word vocalizations) when mastered target responses were presented again an average of 14 days (range: 12- 16) post-intervention in children with ASD. A minimal advantage for MTC was also observed during follow up trials for three participants (Anna, Dave, Laura). No clear advantages were observed in the follow up phase for full word vocalizations or partial word vocalizations Bob emitted after intervention.

An advantage can be found in the MTC condition with the occurrence of two times as many independent vocalizations Bob emitted during the follow up phase (Figure 10). One theory to explain the increase in independent responding observed in both the VA and MTC conditions could be the duration of time between the last intervention session and the first follow up session (absence of intervention). The absence of intervention deprived Bob from access to the preferred items. The researcher held possession of the items to control for access to the items during intervention. Deprivation of access to preferred items may have served as an establishing operation increasing the likelihood of independent responding of the conditioned response when the target stimuli was presented again.

Little-to-no responding was recorded during the follow up phase for Dave. Data show a minimal advantage in the MTC condition with the occurrence of one vocal response. Laura emitted two vocal responses in the MTC condition and did not emit any vocal responses in the VA condition. Laura emitted one full word vocalization (ball) in the MTC condition; the same response was observed to be emitted independently. No response was recorded in the VA condition during follow up, it was unlikely Laura would emit a response during the follow up phase that had not previously been conditioned in the intervention phase.

Full Word Vocalizations

The current study compared the occurrence of full word vocalization to partial word vocalizations. Full word vocalizations included clear imitations of the researcher's vocal presentation (i.e., all syllables must be present, beginning and ending sounds are the same). Full word vocalizations did not include any incorrect word or utterance made by the participant. Partial word vocalizations included any vocal utterance made by the

participant after a motivation to gain access to the target item had been observed. Both conditions produced an increase in full word vocalizations except for one participant (Laura) in the VA condition.

A slight advantage in MTC can be noted in the acquisition of full word vocalizations for at least two participants (Anna and Laura). Anna acquired three full word vocalizations in the MTC condition and two in the VA condition. Anna also emitted four times as many full word vocalizations during follow up in the MTC condition than in the VA condition. Laura acquired one full word vocalization in the MTC condition. Laura did not acquire any vocal response in the VA condition. No advantage can be noted for Bob in the intervention or follow up phase of full word vocalizations in either the VA or MTC condition. There was no clear advantage observed for Dave in the acquisition of full word vocalizations in either the VA or MTC condition.

Prior to intervention, Anna had the most exposure to sign language compared to the other participants. It could be suggested that her history of using the language increased the likelihood that a sign language response would occur due to similar responses having been met with reinforcement in the past. The sign language response or prompt may have served as a second discriminative stimulus that increased the likelihood of the occurrence of a full word vocalization.

Wells (1981) measured the articulation of vocal target responses when comparing the VA condition to TC procedures similar to the MTC training presented in this study. Both conditions improved the articulation of target responses for two out of three participants. The results from all three participants showed a clear advantage in the TC condition. Wells theorized that the sign language response created a point-to-point correspondence chain with the vocal response. Although, this study did not replicate the

strong results found in the Wells (1981) it could be suggested that sign language prompting alone may create a response chain that could slightly increase the likelihood of vocal responding in some individuals with a speech delay.

Independent Vocalizations

Two participants in this current study (Bob and Laura) met mastery criteria of independent vocalizations for some target responses presented in the MTC condition. Both demonstrated a slightly higher level of responding in the MTC condition during both intervention and follow up phases. Bob acquired two more independent vocalizations in the MTC condition during intervention. Laura acquired one independent vocalization in the MTC condition. Laura did not emit any vocalization in the VA condition. Independent vocalizations were not observed to occur during intervention or follow up phases for the other two participants (Anna and Dave).

Tincani (2004) measured vocal manding in two children with ASD. TC training was compared to PECS in the acquisition of vocal responses. Both conditions were found to increase vocal responding in each participant. For one participant, TC training produced a higher percentage of independent vocalized mands. The other participant was noted to have weak hand motor imitation. Tincani (2004) suggests that the sign language response may act as a prompt that could occasion the vocal response to occur.

Similarly, in this study, both the VA and MTC conditions increased vocal responding in all participants. MTC training appeared to have a slight advantage in the occurrence of independent vocal responding. The full physical prompt provided by the researcher in the MTC condition may have served as a second discriminative stimulus, the first stimulus being the vocal prompt, that set the occasion for independent responding to occur when the item was presented again.

Sign Language

In the current study, sign language, paired with a vocal stimulus, was chosen as an independent variable to determine the effects of vocal responding in children diagnosed with ASD. Alternative forms of communication were considered and rejected for the purpose of this study. The use of PECS could also not be completely controlled for as an independent variable. The participants of this research all attended early intervention classrooms, it was likely the participants had some exposure to a picture communication system in their school. However, only one participant (Anna) had exposure to sign language prior to participation in this study.

For the purpose of this research, the occurrence of the sign language response was recorded if it was emitted by the participant after the FV and full physical prompt was provided by the researcher. Participants would sometimes emit the sign language response during trials. However, no participant met the mastery criterion of any sign language response throughout the intervention. Some sign language responses included repetitive hand movements or variations of sign language responses. Sign language responses that were observed across participants, included included blue, ball (Laura), phone, disk, ball, guitar, (Dave), sand (Bob), popcorn, disk, pink, turtle, spinner, alligator, (Anna).

Participants intermittently emitted the sign language response during intervention. Occurrence of the sign language response produced reinforcement of access to the stimulus. However, it was not required in order to receive reinforcement in the MTC condition. This study was the first exposure to sign language for all but one participant (Anna). Anna's school integrated sign language into their curriculum. Throughout the

study, this intervention remained the only exposure to sign language for the other three participants.

Anna did not meet mastery criterion, but she emitted the most amount of sign language responses, this could be due to her history of using the language in school. Bob emitted a limited number of sign language responses during intervention; his vocal imitation skill measured high on the VB-MAPP. It could be argued that a history of reinforcement has already been established with vocal responses, Bob was reported to have no other mode of communication during the time of intervention, therefore, he primarily relied on vocal responding to access preferred items.

Previous Research

Results of this study did not replicate the findings in the Carbone et al. (2006) study. Carbone et al. included three different in-home teachers that delivered the intervention to one participant that served as the only subject of their study. Due to the number of researchers and the ease of access to their participant in the study, they were able to deliver the intervention to their participant with a greater number of trials than the current study allowed. The current study only had resources available for one researcher to deliver the intervention to all four participants. Appointments for the current intervention were limited to primarily the evenings or during weekends.

Additionally, Carbone et al. measured probe trials to determine mastery of vocal responding which required 100% independent responding for all presentations of the stimulus across two consecutive sessions. TC training had a much stronger advantage in the acquisition of vocal responses in the Carbone et al. study than the MTC condition did in the current study. This effect could be in part due to the vast difference in the amount of trials conducted in the Carbone et al. study compared to the limited number of trials

conducted in the current research. The participant in the Carbone et al. study received a total of 7,500 trials in the VA condition and 6,500 trial in the TC condition.

The participants in the current research received an average of 123 (range: 96 – 156) trials in both the VA and MTC conditions. The limited number of trials available for the duration of the current research study determined the mastery criterion of vocal responding. For the purpose of the current study, an echoic response was considered mastered if it was observed to occur in response to the prompt provided by the researcher during all three training trials, across two consecutive sessions. Independent responses were recorded for comparison but not a requirement to meet mastery criterion. Researchers in the Carbone et al. study conducted more trials to determine a mastery criterion of independent responding.

Conclusions

Vocal responding is desirable with any communication training. Both conditions improved vocal responding for all participants, with the exception of the VA condition for Laura. MTC training produced marginal and inconsistent improvements in vocal responding over the VA condition. The occurrence of vocal responding during sign language training is a beneficial finding to further support the discovery that the training of an alternative form of communication does not hinder natural speech development. Results suggest that sign language, when paired with the vocal response, could produce a slightly higher rate of responding in some children who experience speech delays.

Similar to other studies, the sign prompt did not seem to hinder vocal responding and therefore unlikely to hinder vocal language development. An explanation for this advantage could be that the sign language prompt serves as a second discriminative stimulus. The first discriminative stimulus being the vocal prompt. Barrera and Sulzer-

Azaroff (1983) refer to the sign language response as a sensory cue. When in the presence of the second discriminative stimulus, the sign language prompt, it acts as a cue to set the occasion for the vocal response to occur. Although, all participants emitted a limited number of sign language responses throughout intervention, it could be suggested that the researcher's full physical prompt alone served as a second discriminative stimulus that occasioned vocal responding.

Limitations

There were multiple limitations in this study, two participants (Dave and Laura) were informally observed to exhibited little- to- no play skills with physical toys (i.e., cars, blocks, and dolls) prior to intervention. Dave's leisure skills were limited to playing games/ videos on his iPad. He was often observed to engage in problem behaviors when denied access to the iPad or access to the iPad was terminated. He also was observed to put items in his mouth, therefore, potentially toxic items (i.e., playdough, slime, sand, etc.) were not used during intervention.

Laura was also observed to primarily play on an electronic device when not participating in the intervention. This study was conducted during Laura's first year of pre-school. Prior to this year, she had not been exposed to the school environment which introduces a variety of toys, peer models to demonstrate play, and adults prompting structured play time throughout the day. It could be suggested that a lack of exposure to a variety of toys in the home could have weakened the participants' interest in physical toys.

The researcher was also not given much opportunity to use food as a target response / reinforcer due to the time of day the intervention was conducted, parent preferences, and cultural expectations. Food is an unconditioned reinforcer and is most commonly used to reinforce the first mands taught to children. Participants were

observed to show a motivation to gain access to stimuli presented in both conditions; however, their motivation to mand for primary reinforcers might have been stronger.

The setting also proved to be a large limitation in this study. Two participants (Anna and Laura) received intervention in their basement, away from all other distractions. Due to the structure of the other two participants' homes (Bob and Dave), the intervention was conducted in the living room. Distractions such as parents, siblings, conversations, food preparation, and toys were inevitable in their homes and unable to be removed entirely from the area of instruction. Elopements from the table occurred more frequently with Bob and Dave; as well as problem behaviors to gain access to items that were unavailable during intervention.

A third limitation is that data collected for this study was primarily done during the summer months. All participants attended an early intervention preschool during the school year, however, only two participants (Anna and Dave) received outside intervention over the summer. It could be suggested that low rates of responding are resulted by limited exposure to routines, structures, and learning environments during the summer months. Summer schedules often conflicted with the research of this study. Appointments were often rescheduled and conducted at varying times. This was done to accommodate the participants and the schedules of their families.

A fourth limitation was the limited amount of trials conducted, Sundberg and Partington (1998) suggest thousands of trials to be conducted, as demonstrated in the Carbone et al. (2006) study, before a participant will emit a vocal response. It is also suggested by Sundberg and Partington that motor movements are learned so they can be matched with specific vocalizations. The motor movements used for the sign language responses in this study did not require a criterion of mastery to receive reinforcement.

Future Research

Future research is still necessary to determine ideal methods for teaching vocalization and sign language responses to children with ASD. Interventions should examine training motor movements required for sign language responding prior to training a vocal prompt. Participants should be required to emit the sign language response during intervention in order to receive reinforcement. The sign language response may serve as a second discriminative stimulus and set the occasion for a vocal response to occur. By requiring the response to occur during training, it may increase the likelihood that the response will occur independently and generalize to other people and settings. Studies should determine if the sign language response serves as second discriminative stimulus that may occasion vocal responding by determining if the response will generalize to other people and settings when the target stimulus is present.

Participants of this study did not meet mastery criterion of any sign language response during training. At least three participants (Anna, Dave, Laura), seemed to produce a marginal advantage in the rate of vocal responding in the MTC condition. It could be suggested that the sign language prompt alone may serve as a second discriminative stimulus that occasions vocal responding. Individuals with a speech delay may not require training of specific sign language responses to emit a vocal response. Future research may want to determine the effects of vocal responding when sign language prompting is paired with a vocal stimulus.

The acquisition of full word vocalizations is an interesting finding and warrants further research. If the sign language response serves a second discriminative stimulus that sets the occasion for vocal responding, then the topography of each movement of the sign language response could occasion the correct pronunciation of a word. Each

response in the chain of movements in the sign language response is paired with a sound or syllable that makes up one vocal response. Future research should also explore the effects of the articulation of full word vocalizations when comparing MTC training to a PECs condition.

Practical Implications

The parents of the participants of this study had the advantage of observing this in-home intervention and can now incorporate the strategy of sign language prompting when engaged in communication training with their child. Another important finding in this research is that children with a speech delay, who also demonstrate strong vocal imitation skills, will primarily rely on vocal responses to gain access to desired items. Vocal responding is universally used and arguably the easiest mode of communication.

The participants in this study with limited vocal imitation skills (Dave, Laura) benefitted when the vocal response was trained with the full physical sign language prompt in the MTC condition. Modifications to the procedures proposed in this study may find stronger results in the MTC condition. MTC may or may not enhance speech development for all individuals with speech delays. However, there was no evidence in this research to suggest that MTC training would hinder natural speech development.

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APPENDIX A

VB-MAPP: OBJECTIVE MANDING - LEVEL 1

1. Emits 2 words, signs, or PECS, but may require echoic, imitative, or other prompts (no physical prompts) [Observation or Direct Instruction]

_____
_____

Total: _____

2. Emits 4 different mands without prompts (except What do you want) the desired item can be present. [Direct Instruction]

_____
_____
_____
_____

Total: _____

3. Generalizes 6 mands across 2 people, 2 settings, and 2 different examples of a reinforcer [Observation or Direct Instruction].

_____
_____
_____
_____
_____
_____

Total: _____

4. Spontaneously emits 5 mands- desired item can be present [Total Observation: 60 minutes]

_____
_____
_____
_____
_____

Total: _____

5. Emits 10 different mands without prompts- desired item can be present [Observation or Direct Instruction].

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

Total: _____

APPENDIX B

VB-MAPP: OBJECTIVE MANDING - LEVEL 2

1. Mands for 20 different missing items without prompts (except e.g., "What do you need?") [Observation or Direct Instruction]

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

Total: _____

2. Mands for others to emit 5 different actions or missing actions needed to enjoy a desired activity [Observation or Direct Instruction]

_____
_____
_____
_____
_____

Total: _____

3. Emits 5 different mands that contain 2 or more words (not including "I want") [Total Observation: 60 min]

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

Total: _____

4. Spontaneously emits 15 different mands [Total Observation: 30 min]

_____ _____ _____
_____ _____ _____
_____ _____ _____
_____ _____ _____
_____ _____ _____

Total: _____

5. Emits 10 new mands without specific training [Observation]

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

Total: _____

APPENDIX C

FINE MOTOR IMITATION ASSESSMENT

Fine Motor Imitation Assessment					
• Attain eye contact prior to presentation of fine motor action. • Present hands at eye level to ensure participant has clear access to SD. • *SD: fine motor action + "do this."*					
Date: _____			Date: _____		
	Fine Motor Action			Fine Motor Action	
1	Wiggle fingers	Y / N	1	Wiggle fingers	Y / N
2	Pinch (index to thumb)	Y / N	2	Pinch (index to thumb)	Y / N
3	Makes a fist	Y / N	3	Makes a fist	Y / N
4	Points index finger (isolation)	Y / N	4	Points index finger (isolation)	Y / N
5	Holds up 2 fingers	Y / N	5	Holds up 2 fingers	Y / N
6	Pretend to walk of 2 fingers	Y / N	6	Pretend to walk of 2 fingers	Y / N
7	Rabbit ears (2 fingers bent)	Y / N	7	Rabbit ears (2 fingers bent)	Y / N
8	Pushes buttons (on toy)	Y / N	8	Pushes buttons (on toy)	Y / N
9	Squeezes toy	Y / N	9	Squeezes toy	Y / N
10	Pinches clothes pin	Y / N	10	Pinches clothes pin	Y / N
11	Picks up coin, puts in jar	Y / N	11	Picks up coin, puts in jar	Y / N
12	Drumroll fingers on table	Y / N	12	Drumroll fingers on table	Y / N
13	Thumbs up	Y / N	13	Thumbs up	Y / N
14	ASL- letter B	Y / N	14	ASL- letter B	Y / N
15	ASL- letter C	Y / N	15	ASL- letter C	Y / N
16	ASL- letter D	Y / N	16	ASL- letter D	Y / N
17	ASL- letter L	Y / N	17	ASL- letter L	Y / N
18	ASL- letter O	Y / N	18	ASL- letter O	Y / N
19	ASL- letter T	Y / N	19	ASL- letter T	Y / N
20	ASL- letter Y	Y / N	20	ASL- letter Y	Y / N
Total			Total		

APPENDIX D

MSWO: PREFERENCE ASSESSMENT

MSWO Preference Assessment Participant: _____							
Date:	1		2		3		
Target	Selected	Order	Selected	Order	Selected	Order	Notes
1.	Y / N		Y / N		Y / N		
2.	Y / N		Y / N		Y / N		
3.	Y / N		Y / N		Y / N		
4.	Y / N		Y / N		Y / N		
5.	Y / N		Y / N		Y / N		
6.	Y / N		Y / N		Y / N		
7.	Y / N		Y / N		Y / N		
8.	Y / N		Y / N		Y / N		
9.	Y / N		Y / N		Y / N		
10.	Y / N		Y / N		Y / N		
Date:	1		2		3		
Target	Selected	Order	Selected	Order	Selected	Order	Notes
1.	Y / N		Y / N		Y / N		
2.	Y / N		Y / N		Y / N		
3.	Y / N		Y / N		Y / N		
4.	Y / N		Y / N		Y / N		
5.	Y / N		Y / N		Y / N		
6.	Y / N		Y / N		Y / N		
7.	Y / N		Y / N		Y / N		
8.	Y / N		Y / N		Y / N		
9.	Y / N		Y / N		Y / N		
10.	Y / N		Y / N		Y / N		
Date:	1		2		3		

Target	Selected	Order	Selected	Order	Selected	Order	Notes
1.	Y / N		Y / N		Y / N		
2.	Y / N		Y / N		Y / N		
3.	Y / N		Y / N		Y / N		
4.	Y / N		Y / N		Y / N		
5.	Y / N		Y / N		Y / N		
6.	Y / N		Y / N		Y / N		
7.	Y / N		Y / N		Y / N		
8.	Y / N		Y / N		Y / N		
9.	Y / N		Y / N		Y / N		
10.	Y / N		Y / N		Y / N		

APPENDIX E

PROCEDURAL FIDELITY: BASELINE

PROCEDURAL FIDELITY: BASELINE

Participant: _____ Observer: _____ Date: _____

Session #: _____ Item: _____

Leave blank any step not completed and indicate with an X each step completed to accuracy.

1	Item is presented to participant at eye level.	
	Access to item provided for any independent vocalization of item.	
2a	Participant does not show a motivation (i.e., reaching, pointing) for item.	
	Item is removed and re-presented.	
2b	Participant shows motivation for item (e.g., looking at, reaching for, pointing to).	
	Access to item provided after 10 s of no response.	
3	Participant mands for item in sign language.	
	Access to item is provided.	
4	Trainer does not say the name of the item at any time.	

APPENDIX F

PROCEDURAL FIDELITY: VOCAL ALONE

PROCEDURAL FIDELITY: VOCAL ALONE

Participant: _____ Observer: _____ Date: _____

Session #: _____ Item: _____

Leave blank any step not completed and indicate with an X each step completed to accuracy.

1	Item is presented to participant at eye level.	
	Access to item provided for any independent vocalization of item.	
	Item is removed if participant **does not show a motivation**.	
2	Participant **shows motivation** for item (e.g., looking at, reaching for, pointing to).	
3	Vocal prompt provided.	
	Vocalization – praise + no access to reinforcer	
	No Vocalization – no access to reinforcer	
4	Item was removed.	
5	Item was presented again at eye level.	
6	Participant provided access to reinforcer for emitting vocal response.	
7	Item was removed if participant did not emit a response.	

APPENDIX G

PROCEDURAL FIDELITY: MODIFIED TOTAL COMMUNICATION

PROCEDURAL FIDELITY: MODIFIED TOTAL COMMUNICATION

Participant: _____ Observer: _____ Date: _____

Session #: _____ Item: _____

Leave blank any step not completed and indicate with an X each step completed to accuracy.

1	Item is presented to participant at eye level.	
	Access to item provided for any independent vocalization of item.	
	Item is removed if participant **does not show a motivation**.	
2	Participant **shows motivation** for item (e.g., looking at, reaching for, pointing to).	
3	Vocal & Sign Language prompt provided.	
	Vocalization – praise + no access to reinforcer.	
	No Vocalization – no access to reinforcer.	
4	Item was removed.	
5	Item presented again at eye level.	
6	Participant provided access to reinforcer for emitting vocal/ sign language response.	
7	Item removed if participant did not emit a response.	
8	Prompt provided for the absence of or incorrect sign language response.	

APPENDIX H

SOCIAL VALIDITY QUESTIONNAIRE: BEFORE INTERVENTION

Please respond by placing an X on top of the statement that best describes your participation in this research study.

1. How clear is your understanding of this study?

Not at all clear		Somewhat clear		Very clear

2. Do you feel comfortable contacting the experimenter regarding this study?

Not at all		Somewhat		Very

3. Are you comfortable with your child learning sign language?

Not at all		Somewhat		Very

4. Are you interested in the proposed intervention?

Not at all		Somewhat		Very

5. Do you feel this intervention will be beneficial to your child?

Not at all		Somewhat		Very

6. Are you interested in learning the sign language responses used during this study?

Not at all		Somewhat		Very

7. Are you interested in implementing this intervention after the end of this study?

Not at all		Somewhat		Very

8. Do you think this intervention will be disruptive to your daily routine?

Not at all		Somewhat		Very

9. How much discomfort do you think your child likely to experience because of participation in this study?

None		Some		A lot

APPENDIX I

SOCIAL VALIDITY QUESTIONNAIRE: AFTER INTERVENTION

Please respond by placing an X on top of the statement that best describes your participation in this research study.

1. How clear is your understanding of the study and the results?

Not at all clear		Somewhat Clear		Very Clear

2. Did you find this intervention to be beneficial to your child?

Not at all		Somewhat		Very

3. Have you noticed an increase in your child's vocal requests?

Not at all		Somewhat		Very

4. Did you like the study?

Not at all		Somewhat		Very

5. Would you recommend this intervention to another parent?

Never		Maybe		Definitely

6. Are you interested in implementing this protocol after the conclusion of the study?

Not at all		Somewhat		Very

7. Did you child experience discomfort throughout this study?

None		Some		A lot

8. Did you find this study to be disruptive to your daily routine?

Not at all		Somewhat		Very

9. How well will carrying out these procedures at home fit into your routine?

Not well		Somewhat		Very well

10. Is there something you would like to recommend to this intervention?

_____

_____

APPENDIX J

DATA SHEET: BASELINE

DATA SHEET: BASELINE

Participant: ______________________ Interobserver Agreement: Yes/ No

Date		1	2	3	Percent	Notes
	Vocal	Y/N	Y/N	Y/N		
Target	Type	W/A	W/A	W/A		
	ASL	Y/N	Y/N	Y/N		
Date		1	2	3	Percent	Notes
	Vocal	Y/N	Y/N	Y/N		
Target	Type	W/A	W/A	W/A		
	ASL	Y/N	Y/N	Y/N		
Date		1	2	3	Percent	Notes
	Vocal	Y/N	Y/N	Y/N		
Target	Type	W/A	W/A	W/A		
	ASL	Y/N	Y/N	Y/N		
Date		1	2	3	Percent	Notes
	Vocal	Y/N	Y/N	Y/N		
Target	Type	W/A	W/A	W/A		
	ASL	Y/N	Y/N	Y/N		
Date		1	2	3	Percent	Notes
	Vocal	Y/N	Y/N	Y/N		
Target	Type	W/A	W/A	W/A		
	ASL	Y/N	Y/N	Y/N		

Scoring					
	3/3	2/3	1/3	0/3	
	100%	66%	33%	0%	
Full Word Vocalization	**W**	Partial Word Vocalizations	**A**		

APPENDIX K

DATA SHEET: VOCAL ALONE

DATA SHEET: VOCAL ALONE

Participant: ______________________ Interobserver Agreement: Yes/ No

Date		1	2	3	Percent	Notes
	Vocal	Y/N	Y/N	Y/N		
Target	Type	W/A	W/A	W/A		
	Ind.	Y/N	Y/N	Y/N		
Date		1	2	3	Percent	Notes
	Vocal	Y/N	Y/N	Y/N		
Target	Type	W/A	W/A	W/A		
	Ind.	Y/N	Y/N	Y/N		
Date		1	2	3	Percent	Notes
	Vocal	Y/N	Y/N	Y/N		
Target	Type	W/A	W/A	W/A		
	Ind.	Y/N	Y/N	Y/N		
Date		1	2	3	Percent	Notes
	Vocal	Y/N	Y/N	Y/N		
Target	Type	W/A	W/A	W/A		
	Ind.	Y/N	Y/N	Y/N		
Date		1	2	3	Percent	Notes
	Vocal	Y/N	Y/N	Y/N		
Target	Type	W/A	W/A	W/A		
	Ind.	Y/N	Y/N	Y/N		

Scoring

	3/3	2/3	1/3	0/3	
	100%	66%	33%	0%	
Full Word Vocalization	**W**	Partial Word Vocalization		A	

APPENDIX L

DATA SHEET: MODIFIED TOTAL COMMUNICATION

DATA SHEET: MODIFIED TOTAL COMMUNICATION						
Participant: ______________________				Interobserver Agreement: Yes/ No		
Date		1	2	3	Percent	Notes
	Vocal	Y/N	Y/N	Y/N		
	Type	W/A	W/A	W/A		
Target	Ind.	Y/N	Y/N	Y/N		
	ASL	Y/N	Y/N	Y/N		
Date		1	2	3	Percent	Notes
	Vocal	Y/N	Y/N	Y/N		
	Type	W/A	W/A	W/A		
Target	Ind.	Y/N	Y/N	Y/N		
	ASL	Y/N	Y/N	Y/N		
Date		1	2	3	Percent	Notes
	Vocal	Y/N	Y/N	Y/N		
	Type	W/A	W/A	W/A		
Target	Ind.	Y/N	Y/N	Y/N		
	ASL	Y/N	Y/N	Y/N		
Date		1	2	3	Percent	Notes
	Vocal	Y/N	Y/N	Y/N		
	Type	W/A	W/A	W/A		
Target	Ind.	Y/N	Y/N	Y/N		
	ASL	Y/N	Y/N	Y/N		

Scoring					
	3/3	2/3	1/3	0/3	
	100%	66%	33%	0%	
Full Word Vocalization	W	Partial Word Vocalization		A	