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Pilot Study of Multimodal Communication Treatment in Children with Autism Spectrum Disorder

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Pilot Study of Multimodal Communication Treatment in Children with Autism Spectrum Disorder

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Thesis

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Master of Arts

The University of Texas at Austin

May 2014

Dedication

To my father, Dr. Freeman Leigh Rawson III: I know you would have been the first to read my work, and I will continue to work each day as though you are here to cheer me on as you always did.

Acknowledgements

I am grateful for the continuous support and guidance from Dr. Barbara Davis and Dr. Jessica Franco and feel lucky to have had the opportunity to work with women whom I truly respect in our field.

Thank you to my wonderful husband, family, and friends for encouraging me throughout my academic journey and this process.

This would not be possible without Ben and his mother. Thank you for coming to the clinic early each therapy day and allowing me to spend extra time with such a neat child. You have taught me much more than I could have taught you!

Pilot Study of Multimodal Communication Treatment for Communication Breakdowns in Children with Autism Spectrum Disorder

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The University of Texas at Austin, 2014

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In this study, a promising new intervention implemented for adults with aphasia due to stroke, Multimodal Communication Treatment, was modified for its use with one child with autism spectrum disorder to identify if the child could learn and communicate new words through learning multiple modalities. Data was collected on the child's communicative output as well to assess the frequency and types of his communication attempts. The child presented with challenging behaviors throughout the intervention period, and its potential impact on the execution of the intervention was studied. The study found that Multimodal Communication Treatment was not an effective intervention approach for this child. The majority of his output was not communicative in nature and challenging behaviors impacted the effectiveness of implementing the approach. Further research is needed to identify whether Multimodal Communication Treatment could be an effective intervention for children with more communicative intent and increased attention.

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Chapter 1: Introduction

Communication deficits are marked in children with autism spectrum disorder (ASD)(American Psychiatric Association, 2013). A child with ASD may use limited or inappropriate communication modalities to relay a message to a communication partner, which may or may not be understood by the listener. A speech-language pathologist (SLP) providing intervention for a young child with ASD may prioritize increasing communication skills through teaching of several different potential modalities, including vocalizations, gestures, eye-gaze, or augmentative communication. There is limited evidence to guide SLPs in which of these communication modalities is optimal for these diverse child profiles. One potential method for guiding the teaching of early communication skills includes systematically teaching several different modalities and analyzing the child's use of the modalities.

The current study is a preliminary case study looking at the potential effects of an intervention to teach multiple modalities of communication to one child. Multimodal Communication Treatment (MCT; Wallace & Purdy, 2013).) has been identified as a promising treatment for adults with aphasia, but is yet to be studied with children who have ASD. This present case study has potential to provide information for future clinicians on the efficacy of the MCT treatment regime for a child who may exhibit similar deficits.

EVIDENCE-BASED PRACTICE

The effects of intervention to teach effective communication behaviors to a child with limited communication due to a language disorder need to be evaluated carefully in children with ASD. Clinical decision-making in the field of speech-language pathology has generally been based on the clinician's judgments and the wishes of the client and family rather than using evidence from high-quality published research. Zippoli & Kennedy (2005) surveyed 240 SLPs about their attitudes toward the use of evidence-based practice (EBP) as in the medical field. They found that those surveyed most frequently used clinical experience and colleague's opinions to guide decisions in treatment rather than available research studies.

The American Speech-Language-Hearing Association (ASHA) defines EBP as "the integration of: (a) clinical expertise/expert opinion, (b) external scientific evidence, and (c) client/patient/caregiver perspectives to provide high-quality services" (ASHA, 2005). Gillam & Gillam (2005) suggested that evidence-based practice begins with asking a clinical question, then searching for external evidence to answer that question. Once relevant research is gathered, the level of evidence must be determined. These levels are noted in Table 1 below. The highest level of evidence is a random controlled trial (RCT) or a systematic review (SR). RCTs are studies where participants are

randomly assigned to treatment and control groups. SRs are studies that analyze numerous studies related to a certain topic, such as a therapy target. An example of external evidence considered to be on the second level is a comparison of nonrandomized groups. Quasi-experimental studies are also considered to be level 2. These studies evaluate changes in two groups whose performance is measured both before and after a particular study. The groups are not random. Multiple-baseline and single-subject design studies can also fall under level 2, where two or more behaviors are studied across treatment and no-treatment phases and the subject serves as their own control. The third level of evidence in the field of speech-language pathology is a case-control study for a particular treatment. Descriptive case studies fall into level 4. The final and lowest level of external evidence is expert opinion, including best practice statements from ASHA. Before making a clinical decision, the clinician should first evaluate the available research that provides evidence for a certain intervention or treatment. The clinician must then consider the unique characteristics of the child and family involved, including the family's culture, ability to participate in an intervention, financial resources, and interest and opinions. The type of agency and clinician's knowledge is the final factor to be considered before an intervention is chosen. If the clinician does not have the prerequisite knowledge or resources available for a particular intervention, it may not be the most viable for the particular setting. This EBP approach would choose an intervention that will potentially have the most positive outcome on the child given these factors. Table 1

below includes descriptions of both external and internal student-parent and clinician-agency factors that are part of EBP decision-making.

Level	*External (research) evidence*	*Student-parent factors*	*Clinician-agency factors*
1	RCTs and SRs	Cultural values	Education
2	Nonrandomized studies, multiple baseline designs, and SRs	Student-parent activities and participation	Agency policies and financial resources
3	Studies of multiple cases who receive the same treatment	Family financial resources	Clinician data
4	Single case studies	Amount of interest and engagement	Theoretical orientation and recommendations
5	Expert opinion	Opinions	

Table 1: External and Internal Factors in Evidence-Based Decisions (Gillam & Gillam, 2005)

CHOOSING INTERVENTION TARGETS

When SLPs consider intervention targets, they must consider whether the focus should be developmental or functional intervention. Developmental intervention for language is considered when a child is still functioning at or below a preschool level, and targeted goals include forms and functions that typical children acquire between 3 and 5 years of age (Paul & Norbury, 2012). Functional interventions are considered for children who are still in the developing language phase but might be older children or adults, and intervention targets should be focused on helping those clients participate as

independently as possible in mainstream settings (Paul & Norbury, 2012). Clinicians working with children with autism spectrum disorder (ASD) may utilize both developmental and functional intervention targets in order for that child to participate at their highest level of functioning in a school setting. A child who is limited in communication output will still be receiving language intervention at the word level rather than at the phrase level, like the child whose intervention will be described in this study. Semantic targets might be considered a developmental target with the intention of increasing the child's output and thus equipping them with tools to increase their functional communication skills.

MULTIMODAL COMMUNICATION TREATMENT

A relatively new treatment that addresses function targets with adults is multimodal communication treatment (Wallace & Purdy, 2013). It has not yet been studied for its potential as a functional intervention with children with language disorders. Recent research on the efficacy of multimodal communication treatment with adults is described below as a background to considering it for implementation with a child diagnosed with ASD.

Adults with aphasia often experience severe deficits in communication similar to the deficits that young children with ASD experience. Often, conversations are limited because these clients cannot find the right words to communicate. Multimodal

communication treatment is a relatively new treatment method used with adults with moderate to severe aphasia that helps the client to "make verbal and nonverbal representations of a concept more automatic, facilitating switching among modalities" (Wallace & Purdy, 2013). Specific procedures are still being investigated for this treatment, but some research is available suggesting that this intervention could be appropriate for clients with aphasia.

A pilot study investigated the use of MCT with two men with moderate to severe aphasia following left hemisphere stroke (Purdy & Van Dyke, 2011). One participant presented with non-fluent Broca's aphasia, and the other presented with fluent Wernicke's aphasia. The single subject AB design was completed over two one-hour sessions per week for five weeks. During the intervention, the researcher presented a picture to the participant and prompted the participant to demonstrate at least four ways to communicate the meaning of the picture. The researcher would then demonstrate the verbal, written, and gestural form of the concept or word as well as point to its picture on a communication board and have the participant imitate each modality. Once the participant showed mastery of the word without modeling, the next target was introduced. Post-treatment, the participant with Broca's aphasia increased his number of responses to the stimuli presented and also demonstrated more frequent use of other modalities (71% of the time after a communicative attempt failed as opposed to 28% at baseline), although his main means of naming was verbal. The participant with Wernicke's aphasia could not

spontaneously provide a response for about half of the concepts presented throughout the treatment and needed frequent cues by the researcher. His naming of concepts remained inconsistent. However, he increased his use of switching to another modality when his initial attempt failed 45% of the time post-treatment as opposed to 6% at baseline. This study, although only demonstrating the effects of the treatment on two individuals, suggested that providing the client with multiple nonverbal modalities through an integrated training approach could help the client access other expressions of the concept more automatically.

The current study is a pilot study investigating the use of a modified form of MCT with one child with ASD to examine whether a child with limited verbal output could learn to use multiple different modalities to communicate target words with others. The study will target words that the participant does not know rather than targeting words that were previously in the participant's lexicon, as with prior studies of MCT. Further, this study will investigate the nature of the participant's communicative output and the potential role of behavior and attention and its impact on the execution and efficacy of this intervention.

Chapter 2: Overview of Learning Profiles of Children with Autism

In order to provide a framework for teaching communication modalities to children with autism spectrum disorder (ASD), the learning profile of these children must be explored. This chapter will describe the current evidenced-based understanding of the communicative profile of imitation, initiation, and response, semantic skills and word learning in children with ASD, and the impact of challenging behaviors on response to intervention for ASD.

COMMUNICATIVE PROFILES IN ASD

Children with ASD are a heterogeneous population and thus present with varied communication skills. Deficits in pragmatic skills are a core characteristic of ASD. Research has noted that children with ASD "contribute little new information to conversation, insert irrelevant remarks into conversations or narratives, and have trouble following a partner's conversational topic" (Wilkinson, 2000). Echolalia, immediate and delayed repetition of words or whole phrases, is another common feature of children with ASD (Prizant & Rydell, 1993). Wetherby (1993) suggested that the first emerging communicative intention for children with ASD is behavior regulation, and that social interaction and joint attention are more challenging intentions that typically developing children communicate before their first year of life.

Wetherby et al. (2007) studied social communication profiles of 50 children with ASD, 23 with other developmental delays, and 50 who were typically developing, all aged between 18 and 24 months. Videotaped interactions of all children were scored against the *Communication and Symbolic Behavior Scales* (CSBS, Wetherby & Prizant, 2002). The social, speech and symbolic composites include word, gesture, and action inventories, eye gaze and shared affect, and acts for behavior regulation, social interaction, and joint attention. The authors found significant group differences for all 14 of the social communication measures examined between groups. Large effect sizes for all measures were found between the typically developing group and the children with ASD. Significant effect sizes for the group with developmental delays and the group with ASD in the domains of gaze shifts, gaze/point follow, rate of communication, and acts for joint attention. These communication acts seem to be key differentiating characteristics in young children with ASD.

Studies have shown that early language ability is associated with later academic achievement as well as social communication (Howlin et al., 2000). Early skills associated with developing language and communication skills include joint attention, imitation, and toy play (Toth et al., 2006). Joint attention can include sharing attention, following the attention of another, and directing attention of another. Toth et al. (2006) followed 60 children with ASD between 34 and 52 months until they were 65 to 78 months of age. The *Early Social Communication Scales* (ESCS; Mundy et al., 2003) was

administered to measure proto-declarative and proto-imperative joint attention behaviors. Proto-declarative joint attention could occur any time during the assessment and measured how often the child used eye gaze, showing, and/or point behaviors to direct the attention of or share attention with the researcher. Proto-imperative joint attention was scored any time the child requested a toy or help through eye gaze, pointing, or giving the toy to the researcher. The children's ability to imitate motor movements was assessed through a task where 10 motor imitation items were administered in two blocks, five immediate and five deferred. The researcher modeled simple actions on objects and then told the child it was their turn. Ten minutes later the children were brought back into the room, then presented with the objects again. Toy play was assessed through presenting each child with several dolls and both actual and symbolic objects. First the child was given the toys to play with unprompted. They were then prompted either through gesture or verbally if no target actions were performed on the objects. The authors found that proto-declarative joint attention and immediate imitation were most strongly correlated with language skills in the participants with ASD. Toy play and deferred imitation were predictive of rate of development of communication skills over the next few years as well. Since these early skills seem to be crucial building blocks to later language achievement, joint attention, imitation, and toy play should be targets in early intervention.

SEMANTIC SKILLS AND WORD LEARNING

Semantics is the language domain referring to language content, including the knowledge and use of vocabulary to express and comprehend objects and events (Paul & Norbury, 2012). One model views language learning as the integration of social factors with speech perception-production factors (Kuhl, 2007). Research on children with ASD has produced varied results in the semantics domain (Eigsti et al., 2011). Hermelin & O'Connor (1967) noted that children with ASD were no better at recalling sentences than simple word lists as compared to typically developing (TD) peers, suggesting that semantic structure was not incorporated into processing of speech on-line. However, a study of young children with ASD showed that the children with ASD matched their TD peers on mapping novel words onto novel objects (Tak et al., 2008). This outcome fits the hypothesis that children with ASD use the mutual exclusivity bias, which assumes that each object has only one category label, making a child avoid a second label for a single object (de Marchena et al., 2011).

High-functioning children and adolescents with ASD were assessed to test if these children were using mutual exclusivity in word learning and if the same children applied exclusivity to other referential acts, including factual information (de Marchena et al., 2011). Forty-eight participants with ASD were shown two novel objects, one of which was given a novel label (e.g. "wug"), then were asked to choose an object using a second novel label. Another condition gave the objects a factual label (e.g. "This one is from

California.") and asked the participants to give a second factual label. The authors found that the participants showed mutual exclusivity for both words and facts, but that the tendency to do so was much stronger for words. Despite the pragmatic deficits that children with ASD may exhibit, research suggests that they are able to infer that a novel word refers to an object that has not been named. It is important to note that these children were high functioning, and that the variable nature of ASD presents a challenge for generalizing findings of studies to the population as a whole.

Norbury and colleagues (Norbury et al., 2010) examined how children with ASD learn words despite presenting with social communication deficits through studying eye movement and behavioral evidence Thirteen verbal children with ASD and thirteen TD children aged between 6;8 and 7;9 participated in the study. While the children with ASD in this study scored lower than their peers in their ability to define words, the children with ASD did have age-appropriate vocabulary levels. An eye-tracking camera was set up underneath a computer monitor. On the computer, a woman stood behind three novel objects on a table. In neutral trials, the woman gazed directly into the camera, and in biased trials she gazed at the target object, then said, "Show me the X." In both trials, children were instructed to click on the object to which the woman was referring. During the study, all children were able to choose a target object faster and more accurately when someone was looking at it, showing sensitivity to gaze cues. However, the TD children in this study appeared to be more sensitive to the social cues from the woman's face,

indicating that while the children with ASD did use eye gaze as a cue, they did not use social cues to the same extent as TD peers. A significant finding from this study suggested that the TD children improved performance over time on these word-learning tasks, whereas the children with ASD did not. This may be because the children with ASD focus on the phonological form of the word rather than the meaning behind it, and therefore do not have the full representation of the word with its meaning.

Sigafoos et al. (2004) studied the use of voice-output communication aids (VOCAs) as a potential communication repair strategy for children with limited verbal output. Two students with developmental disabilities, a 16-year-old male and a 20-year-old female, were chosen for the study. Both of the students were nonverbal and relied on prelinguistic means to communicate and had no prior experience using an augmentative and alternative communication (AAC) device. The use of a VOCA was implemented during morning snack because both participants willing participated in snack time in their respective educational settings. The researchers recorded three target behaviors: *behavioral indication* if the student attempted to gain access to the tray of foods, *VOCA use* if the student pressed the VOCA switch to produce the recorded message, "I want more," and *combined use* if the participant used both behavior indication and the VOCA. The researcher also implemented repair probes by ignoring the participant's first request for ten seconds to study if and how they attempted to repair. At baseline, both students were using behavioral indications, such as pointing, to gain access to snack. If their first

request was ignored and a communication breakdown occurred, the students both persisted with the original behavior, and neither used the VOCA as a repair strategy. Once the intervention began, both students began using the VOCA to repair after their first attempt to communicate was ignored. In addition, both participants increased their use of VOCA in combination with a behavior indication. This initial study suggests that VOCA use can be taught as an effective means of communicating words, although this research only studied two participants in a setting where the participants were completing a preferred activity, in this case, eating a snack. MCT, like VOCA, is an intervention that provides alternative means of communicating words, but neither intervention has been researched as a strategy for young children with ASD.

CHALLENGING BEHAVIORS

There is some research to suggest that attention impairments in ASD can interfere with word learning (Baron-Cohen et al., 1997). Disruptive and aggressive behavior can affect not only the child but also their parents and teachers, which can lead to a child with ASD's placement in a more restricted environment (Tyrer et al., 2006). Challenging behavior consistent with oppositional defiant disorder (ODD) and conduct disorder (CD) are reportedly common in children with ASD (Kaat & Lacavalier, 2013).

Kaat & Lacavalier (2013) systematically reviewed studies on challenging behaviors in children with ASD to examine the prevalence and manifestation of these

behaviors and their potential effect on learning in order to inform clinical practice. A combined prevalence rate from the seven studies that discussed prevalence of disruptive behavior disorders in children with ASD found that one in four children with ASD meet diagnostic qualifications for a comorbid disruptive behavior disorder, such as ODD and CD. Rates of diagnosis and symptom severity did not appear to differ between males and females. Aggression was identified as the most common behavior, included in 52% of the studies.

Other studies included conduct problems and antisocial behavior, irritability, and oppositional behavior. Over 50% of children with ASDs engage in aggression (Mazurek et al., 2013). Irritability can include self-injurious behaviors and tantrums, and appears to be more common in children with ASD than typically developing children (Mayes et al., 2011). Disruptive behaviors in ASD may occur for the purpose of escaping a demand, but could also function as a way to access restricted and repetitive behaviors (Reese et al., 2005). Behaviors functioning in this manner may indicate that they are core-ASD behaviors rather than comorbid behaviors. The review found limited evidence for effective interventions aimed at reducing challenging behaviors. The goal of targeting challenging behaviors in intervention is replacing challenging behaviors with more appropriate communication skills (Goldstein, 2002).

Repetitive and restricted behaviors are a core characteristic of ASD. These behaviors can consist of repetitive motor and sensory behaviors and insistence on

sameness, including narrow interests, rigid routines, and rituals (Richler et al., 2007). These behaviors may exist as a coping mechanism; to regulate the child's environment by either increasing sensory stimulation or soothing if the child is over-stimulated (Zentall & Zentall, 1983). Lidstone et al. (2014) studied the relationship between restricted and repetitive behaviors and anxiety in children with ASD (Richler et al., 2007). Parents of 49 children with ASD aged between 3 and 17 completed a *Repetitive Behavior Questionnaire 2* (RBQ-2) asking the parent to assess the degree to which a variety of behaviors were present, including repetitively fiddling with toys, spinning self around and around, and insisting on aspects of routine remaining the same. Parents also completed a 125-item Sensory Profile (Dunn, 1999), where parents indicate the frequency of their child's reactions to different sensory experiences. Additionally, parents completed the *Spence Anxiety Scale-Parent Version* (SCAS-P; Spence, 1998) or the *Preschool Anxiety Scale* (PAS; Spence et al., 2001) to assess a child's anxiety. Researchers found that anxiety was significantly associated with insistence on sameness behaviors, such as insisting on things remaining the same, but not associated with repetitive behaviors. These findings suggest that repetitive motor behaviors may more effectively regulate anxiety in children with ASD, whereas the insistence on sameness behaviors could help create and maintain anxiety rather than regulate sensory input for a child with ASD.

Challenging behaviors such as aggression and repetitive behaviors such as spinning around can limit a child's attention and engagement, which can affect intervention and learning. A study by May et al. (2013) examined the relationship between academics and attention in children with ASD. The participants included 64 children with ASD between 7 and 12 years of age compared to 60 typically developing children. Visual attention was studied through a computerized task where a child is asked to search for a certain type of object to reveal a monster behind it while distractor items are placed on the screen as well. A computerized attention-switching task has the child search alternately search for two shapes before revealing a hidden monster. A sustained attention task on the computer has the child watch for a yellow border appearing randomly around a target shape, then click on it within seven seconds before the border disappears. These tasks have been found to distinguish good and poor attention in a variety of developmental conditions (Cornish et al., 2008). Academic achievement was tested through the Word Reading and Numerical Operations subtests of the Wechsler Individual Achievement Test II, Australian version (Wechsler, 2007). Correlation coefficients were calculated to determine the relationship between variables. Results found that academic achievement and performance on the sustained attention and attention switching tasks were similar between typically developing children and children with ASD. However, attention switching was associated with mathematical scores. According to this study, children with ASD who made more errors on the visual search

task were likely to have lower mathematical scores. This could potentially suggest that switching attention should be a target for intervention for children with ASD as it could impact academic performance, and later future life outcomes.

There is more research needed on the communicative profile of children with ASD as well as their ability to learn words and the impact of challenging behaviors on intervention. The present case study will answer these questions: Can a child with ASD learn to communicate a word using multiple different modalities through a modified form of Multimodal Communication Treatment (MCT), where unknown words rather than previously known words are targeted? What is the nature of the child's communicative output and the potential impact using a communication-based intervention such as MCT? In what ways might challenging behavior impact the execution and effectiveness of intervention?

Chapter 3: Case Study

The current study is a pilot study investigating the use of a modified form of Multimodal Communication Treatment (MCT) with one child with ASD to examine whether a child with limited verbal output could learn to use multiple different modalities to communicate target words with others. The literature described in the previous chapter presented an overview of some of the barriers to communication present in children with ASD and the need for more research on potential intervention approaches. Data will be collected on the child's communication output throughout the study to assess the potential for a child with a similar communicative profile would be an effective candidate to receive MCT as a potential intervention. Further, this study will investigate the potential role of behavior and attention in this child and its impact on the execution and efficacy of this type of intervention that is designed for adults. This chapter describes the participant of this study, the procedures for conducting the study as well as methods for data collection and results of the study.

PARTICIPANT

The participant's name has been changed to Ben in order to protect his identity. Ben is a 6;9 year-old male who lives with his mother and grandparents. His father passed away in 2010. English is the primary language spoken in the home, but Ben is also exposed to the Vietnamese and Chinese languages. At birth, Ben's umbilical cord was wrapped around his neck, causing cyanosis, but he suffered no other medical

complications at that time. Ben suffered from earaches beginning from 9 months of age, and had an adenoidectomy and pressure equalization (PE) tubes put into his ears. Ben's mother reported that Ben met appropriate motor milestones, however, his speech and language were significantly delayed. Ben was diagnosed with autism spectrum disorder in 2009 by a pediatric neurologist, and was evaluated at the University of Texas Speech and Hearing Center (UTSHC) for speech and language delay in 2009, where he was diagnosed with a mixed receptive-expressive language disorder secondary to autism. Ben has been attending UTSHC for speech and language therapy since 2010. He attends public school, where he is in a special education classroom and receives speech therapy in school twice a week for 30 minutes.

CURRENT STATUS

Ben's current goals in therapy are focused around increasing his pragmatic language skills, improving receptive and expressive language skills, and improving cognitive academic language proficiency skills (CALPS) and reading and writing skills while minimizing distracting behaviors, such as crying and tantrums. Ben's current goals around increasing expressive language skills could indicate that he is a good candidate to receive MCT as an intervention. Distracting behaviors are not typically observed in adult clients who may receive MCT intervention. As such, they present an opportunity to evaluate whether the principles of MCT can be transferred to children diagnosed with MCT. Ben's most recent progress report states that although he exhibited some difficulty

attending to therapy tasks, he has shown significant improvement in following one- and two-step directions and produced as many as 23 spontaneous utterances during a therapy session. The majority of Ben's output consists of unintelligible vocalizations. He also engages in a variety of self-stimulatory behaviors during therapy, including looking at himself in the mirror, spinning, and repeating noises. Ben is able to read words and books but does not answer comprehension questions. Ben's mother reports that while Ben is able to use words, he generally does so by repeating a model rather than expressing himself spontaneously. The *Expressive One-Word Picture Vocabulary Test, Third Edition* (Brownell, 2000) was administered informally to gather more information about Ben's semantic skills and ability to label. No standard score was obtained, and the clinician began at the age 2;0-2;11 starting point rather than beginning at Ben's chronological age starting point according to the test instructions. Ben accurately labeled 30 of 53 pictures presented during the task, and reached the ceiling (six inaccurate answers in a row) before reaching the 7;0-7;11 starting point. This informal test indicated that Ben's vocabulary skills may be low as compared to children who are typically developing who are his chronological age. Ben's spontaneous communication is extremely limited. However, his ability to label is a relative strength in comparison. Ben had difficulty labeling categories when presented several images of items together. For example, one question asked, "What are these?" and presented several toys. Ben simply said, "bear," labeling one of the items he saw in the image. Ben was unable to name any

categories during the informal testing. Ben gave labels for almost all of the words (48 of 53), but tended to mislabel the word with a semantically similar word (e.g. “fish” for “mermaid,” “doctor” for “dentist,” “cat” for “raccoon”).

INTERVENTION

Ben currently presents with some language deficits that can interfere with his ability to effectively interact with others, which is a necessary skill for a school-aged child. The researcher implemented a modified form of multimodal communication treatment (MCT) in order to assess whether Ben would increase his ability to label certain words by learning multiple ways to communicate the particular unknown word. In initial studies with adults, the assumption is that the adult has aphasia due to a stroke, so while their communication output could be limited due to deficits from aphasia, the adults previously had a semantic representation of the target words prior to the treatment. The words chosen for Ben were words he either did not have a semantic representation for or labeled incorrectly.

The specific steps involved in executing MCT are still being investigated, but earlier studies have involved presenting a target to a participant and asking them to name the target. Then the clinician asks the participant to provide as many other ways to communicate the target as they can (Purdy & Van Dyke, 2011). This procedure was adjusted for this case study as words were chosen that Ben did not know, and the

intervention was conducted in three phases. Each phase introduced a new modality to communicate the targets.

Ben received treatment for 20 minutes twice a week at the University of Texas Speech and Hearing Center (UTSHC) for five weeks. This is a substantially shorter intervention period than in a pilot study of MCT, where participants were seen twice a week for one-hour sessions (Purdy & Van Dyke, 2011). Treatment consisted of a play task and a book-reading task where all selected vocabulary words were targeted. The clinician introduced the target words through each task. For example, target words included, "see," "hear," "taste," and "touch." The clinician directed Ben's attention to a book that included these words and prompted Ben to read each page. After Ben read a page that included a target word, the clinician stopped and reinforced the target word and prompted Ben to repeat the word. An example of a play task included presenting with a toy car set and allowing Ben to begin playing with the toys. Then the clinician would engage in parallel talk, such as saying, "Look! You are playing on the *street*," to highlight the target word, "street." The clinician would encourage Ben to repeat the target words presented in each play task. Engaging play and book tasks were incorporated to engage Ben, although MCT is usually implemented by sitting down with a clinician and drilling the target words while prompting for the client to demonstrate different modalities that the client can use to communicate those words (Wallace & Purdy, 2013).

The multimodal communication teaching included three phases of instruction. The first three sessions were the *spoken word-only* condition, where the clinician only taught the spoken form of the word. During the naturalistic intervention tasks, the clinician used auditory bombardment by repeating the words without asking Ben to repeat them, as well as prompting him to use the verbal forms. Auditory bombardment is a technique used in the Cycles approach to intervention in phonology (Prezas & Hodson, 2010). The next three sessions the clinician used *both the spoken form of the word in tandem with the manual sign*. The final three sessions combined use of the *spoken word, manual sign, and use of Ben's Dynavox*.

BEHAVIOR DURING SESSIONS

Ben arrived to each session with his mother. Sessions were held after Ben's school day and before his scheduled therapy at the UTSHC. Ben generally fell asleep in the car during the drive to the UTSHC, which made it challenging to awaken him and remove him from the car as well as engage him enough to come to the therapy room. During two sessions, Ben would not come back to the therapy room without his pillow, and he brought a snack with him for three of the sessions. Ben often cried intermittently throughout the intervention session, with the beginning portion being the most challenging for him to self-soothe and engage. Behaviors present included kicking the wall, throwing his body on the floor, and refusal to sit with the clinician to engage in a task. When calm, Ben was prone to distraction. The therapy room included a two-way

mirror, which Ben stood in front of often to engage in repetitive behaviors, and a computer, which distracted Ben as well. Ben oscillated between brief periods of engagement and distraction, where he moved around the room or engaged in various behaviors. This behavior stands in contrast to the MCT protocol used with adults, as the adults who receive the treatment maintain adequate attention to sit and engage with the clinician throughout their session. The researcher could not adhere to this protocol with Ben during the sessions, and instead attempted to redirect Ben with positive reinforcement throughout the treatment period.

Ben's attention was variable throughout intervention sessions, which led to limited engagement with the intervention tasks. Ben arrived at the facility following his school day and his mother reported that he generally fell asleep in the car on the way to the UTSHC. Due to the challenge of maintaining Ben's attention, time spent actively engaged in intervention tasks was limited.

DATA COLLECTION

Selection of Target Words

Ben's mother completed the *MacArthur-Bates Communicative Development Inventories – Words and Gestures* (Fenson et al., 2007), . Ten words were chosen that Ben's mother reported that he did not know or use. Five words were nouns (e.g. "sweater," "watch") and five words were verbs (e.g. "hurt," "see"). Ben was presented

with the list of words three different times in picture form prior to beginning the intervention to establish a baseline and indicate that he was unable to label any of the ten words prior to treatment. This was not consistent with the protocol suggestions for adults, which chose target words to which the client already had a semantic representation, but due to aphasia had difficulty communicating using speech (Purdy & Van Dyke, 2011).

Measurement of Communication Modalities

A probe task was completed at the beginning of each session to assess Ben's ability to label the target words and to identify which modality he used to express each word to indicate if Ben was responding to MCT by using different modalities. For each word, a picture of the target word was presented and Ben was asked, "what is this?" or "what is he doing?" The clinician recorded the response and modality used to label the picture.

Measurement of Communicative Nature of Utterances

In order to investigate the nature of Ben's verbal output, all of his utterances were coded for each session. This measurement was taken to compare the communicative profile of a child with ASD like Ben to the typical client with aphasia who receives MCT. Utterances were either described as *communicative* or *non-communicative* (See Table 2) and the percentage of each type of utterance of his total output was calculated.

Communicative utterances were further coded into three categories: *imitation, initiation, and response*.

Measurement of Challenging Behaviors

Ben's intervention sessions were divided into one-minute intervals. Behaviors examined included *self-stimulatory behaviors*, such as repetitive vocalizations or making faces in the mirror, *escapist behaviors*, such as crying, tantrums, or flopping, and *engagement* in the intervention tasks, which includes *imitations, initiations*, or *responses*. In each one-minute interval, the clinician indicated if the behavior was present or not. The percentage of total intervals where the behavior was presented was calculated and is described in the Results section. Table 2 below consists of definitions of relevant terms used in the data collection process.

Term	Definition
Communicative act	Intentional communication by participant
Non-communicative act	Unintelligible vocalizations or sounds produced by participant that do not serve a communicative function
Escapist behavior	Crying, tantrums, flopping, or destructive behavior
Self-stimulatory behavior	Repetitive or stereotypical behaviors such as repetitive noises or spinning
Engagement	Participation in task
Imitation	Imitation of clinician
Initiation	Spontaneous, initiated communication
Response	Response to question or prompt

Table 2: Definitions of Relevant Terms Used to Describe Behaviors

Reliability and Fidelity Measurements

As a reliability measure, a graduate clinician in speech-language pathology watched 22% of sessions to confirm agreement with the researcher's results of the labeling task. This clinician was in 100% agreement for these sessions. To measure fidelity, a graduate clinician in speech-language pathology watched 22% of sessions to confirm that the intervention was carried out in the manner described. The graduate clinician received a checklist of ten procedures (Targeting all ten words, incorporating target words into a book task and play task, clinician modeling all three modalities to communicate the word, clinician prompting the participant to imitate the words and manual signs, auditory bombardment of target words, redirecting the participant when

distracted from task). For the sessions observed, the objective graduate clinician found that during one of the sessions, only eight words were targeted during the intervention tasks. This issue of time constraints preventing the effectiveness of executing the intervention is further discussed in Chapter 4: Discussion.

Chapter 4: Results

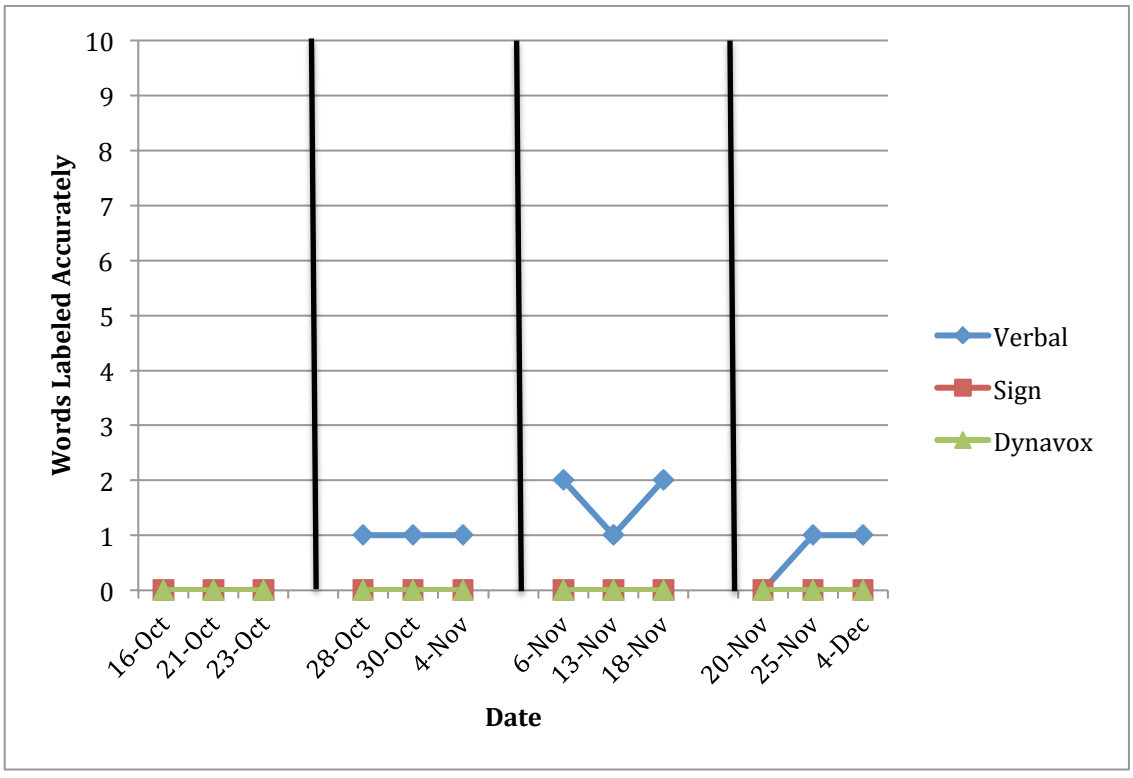
The goal of this case study was to investigate the use of Multimodal Communication Treatment (MCT) as an intervention approach with a child with ASD. To evaluate this type of intervention approach with a child diagnosed with ASD, MCT was modified by introducing three different modalities to communicate ten different target words: spoken word, manual sign, and use of a Dynavox. The results from the case study include data on Ben's word-labeling probe task, Ben's types of utterances, and interval data on which behaviors were present throughout the intervention sessions. These domains were studied to better describe the child used in the study and identify which communicative and non-communicative behaviors might impact the implementation of MCT. With more information about the communicative profile of a client, future clinicians can better choose effective intervention targets and integrate the highest level of available evidence to evaluate whether or not MCT might be an appropriate approach.

Measurement of Communication Modalities

Figure 1 displays the results from the probe task given at the beginning of each session. Phases of the study displayed in the graph include: (1) baseline, (2) the spoken word condition, (3) spoken word and sign condition, and finally (4) the condition using all modalities, the spoken word, sign, and Dynavox. Results showed that Ben only used the spoken modality to label the words during the probe task and did not adopt the other

two modalities despite his exposure to them during the intervention. Although Ben showed some imitation of the manual signs during the intervention, he did not use the signs spontaneously or during the probe task. Ben inconsistently was able to verbally label two of the ten words targeted during the intervention. It is possible that inconsistency of Ben's ability to label the words could be due to limited engagement during the administration of the probe task.

Figure 1: Measurement of Communication Modalities Probe Task



MEASUREMENT OF COMMUNICATIVE NATURE OF UTTERANCES

Ben's types of utterances were divided into two different categories (see Figure 2): non-communicative acts and communicative acts. Non-communicative acts consisted of unintelligible non-word verbalizations, usually in consonant-vowel form, or cries. Communicative acts consisted of imitations of the researcher, communication initiations, and responses to questions or prompts. Ben's utterances were tallied for each session. Non-communicative and communicative utterances were calculated as a percentage of total utterances. In five of nine sessions, Ben's non-communicative verbalizations composed over 50% of Ben's utterances. Ben's utterances were more communicative in four sessions. In two of those sessions, Ben produced greater than 60% communicative utterances. During sessions where Ben used more communicative utterances, he was more engaged with the researcher and the tasks provided, and thus more likely to initiate, imitate, and respond to the researcher. More information on the nature of Ben's communicative utterances will be discussed (see Figure 3). Figure 2 below illustrates Ben's communicative and non-communicative utterances as a percentage of the total amount of utterances in each session.

Figure 2: Non-communicative and Communicative Acts as Percentage of Total Utterances

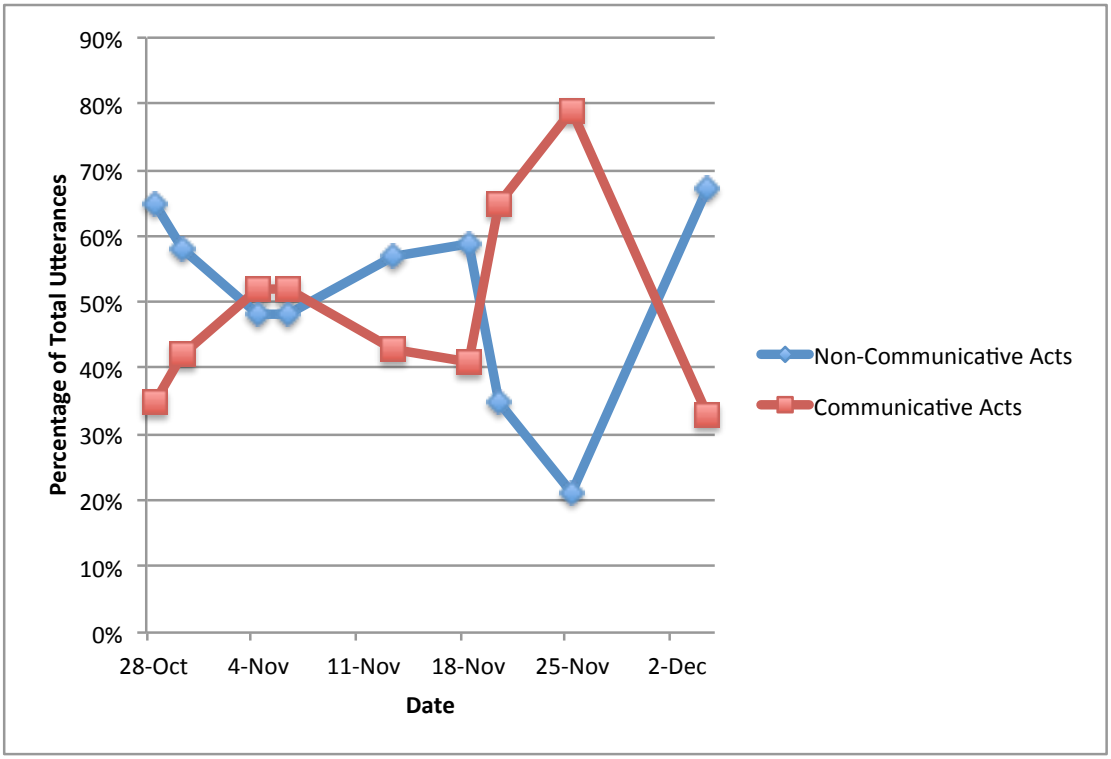
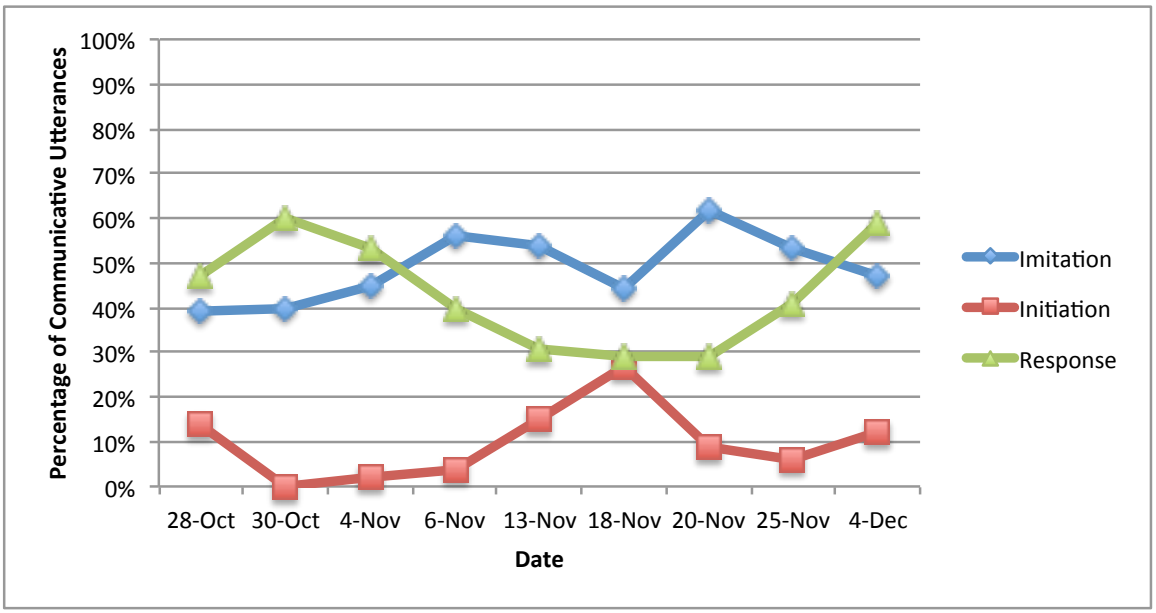


Figure 3 further divides Ben's communicative utterances into initiation, imitation, and responses. These different communicative acts were totaled and then displayed as a percentage of total communicative utterances per session. Imitations made up between 40 and 60% of communicative acts each session. When Ben attended to the task, he tended to imitate target words in a productive manner; however, Ben also imitated parts of

phrases said by the clinician in an echolalic fashion. Responding to questions and prompts made up 30 to 60% of communicative utterances. Ben initiated spontaneously less than 20% of the time in eight of nine sessions. The one session where his initiations made up 29% of communicative acts was still the least-used type of utterance.

Figure 3: Imitation, Initiation, and Responses as Percentage of Total Communicative Utterances



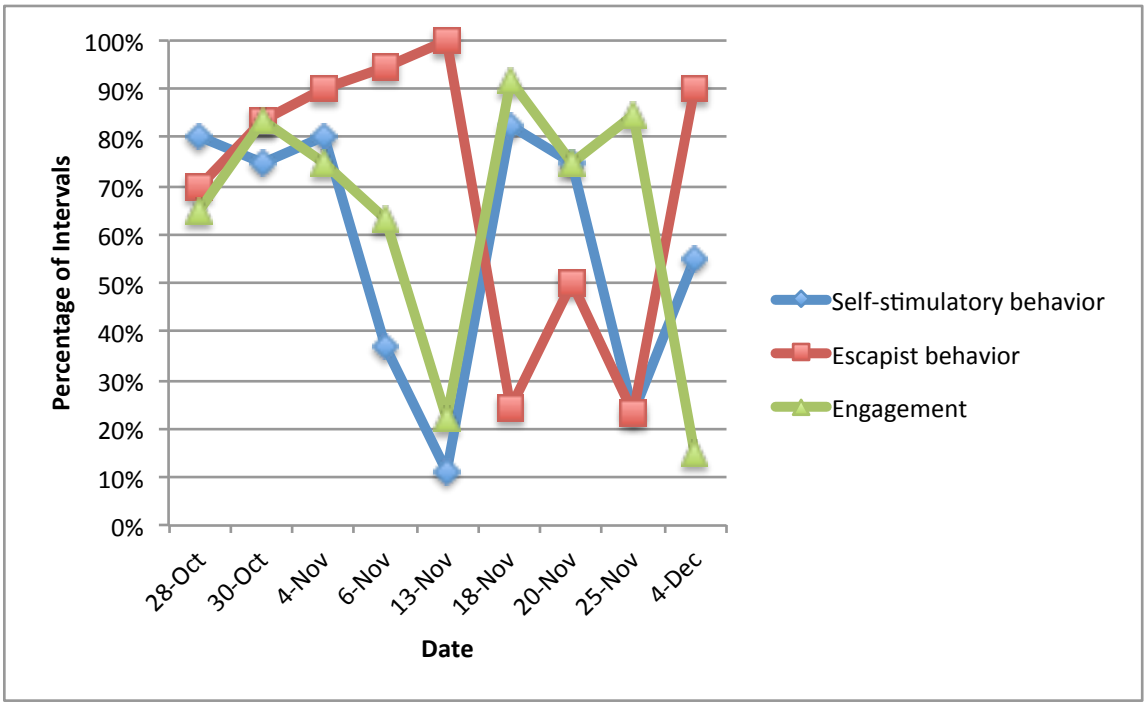
MEASUREMENT OF CHALLENGING BEHAVIORS

Each session was divided into one-minute intervals, and the clinician indicated if particular behaviors were present or not during each interval. The pertinent behaviors

included *self-stimulatory behaviors*, including repetitive and stereotypical behaviors, *escapist* behaviors, such as tantrums or flopping, or *engagement* in the task. Figure 4 below displays the percentages of intervals where each behavior was present during the session. Ben exhibited *escapist* behavior in over 70% of intervals for five of the nine sessions. This result indicates that Ben's attention was limited intermittently throughout the majority of intervention sessions. Ben also exhibited self-stimulatory behaviors in a high percentage of intervals in six of nine sessions. Ben's engagement was variable throughout the interventions. One session he showed engagement in the tasks in over 90% of intervals and in two sessions, he engaged in less than 25% of intervals. Five sessions indicated a possible inverse relationship between escapist behavior and engagement. In three of these sessions, escapist behavior occurred in less than 50% of intervals and engagement was present in over 75% of intervals. In contrast, in two sessions, escapist behavior occurred in over 90% of intervals and engagement occurred in less than 20% of intervals. However, in four sessions both escapist behavior and engagement occurred in over 60% of intervals, although escapist behaviors occurred in a higher percentage of intervals. Self-stimulatory behaviors occurred in an equally high percentage of intervals as engagement in seven sessions, which may suggest that it is possible for Ben to engage in self-stimulatory behaviors and maintain some engagement in presented tasks. Ben's engagement did seem to be affected by his attention and mood throughout the intervention period. This issue of behavior has implications for the

effective execution of MCT intervention. These implications will be discussed in the Discussion section.

Figure 4: Interval Data of Behaviors Present During Sessions



Chapter 5: Discussion

This chapter discusses the results of this study and the possible factors contributing to the results. Recommendations for future research are also described.

This study investigated the use of a modified form of MCT that targeted novel, rather than previously known words with one child with ASD to examine whether a child with limited verbal output could learn to use multiple different modalities to communicate target words with others. The nature of the participant's communicative output and the potential role of behavior and attention and its impact on the execution and efficacy of this intervention were also examined.

The intervention targeted ten words. Ben appeared to learn two of the words through the course of the intervention period, although he did not label them consistently. Ben did not adopt alternate modalities to label the words besides speech. Ben showed inflexibility in changing the labels he incorrectly used at the baseline period, for example, he consistently labeled the item, "sweater," as "shirt" even at the end of the intervention period. Based on the results of this pilot intervention. Ultimately, multimodal communication treatment (Wallace & Purdy, 2013) previously studied with adults with aphasia was not an effective method for teaching this child with ASD who is functioning at a younger developmental language level to communicate a word via multiple

modalities. Several potential variables may have affected these negative outcomes, including lack of attention to the teaching tasks and high rates of challenging behaviors.

Throughout the intervention period, the majority of Ben's vocalizations consisted of repetitive non-words or cries. These behaviors are consistent with both stereotypical, self-stimulatory behaviors and tantrums associated with escapist behaviors. These vocalizations were not communicative in nature and prohibited Ben from engaging in tasks during the intervention. Prior studies with MCT have been completed with adults with aphasia who are exhibiting communicative intent and motivation to participate in sessions (Wallace & Purdy, 2013; Purdy & Van Dyke, 2011), which Ben did not display throughout the majority of intervention sessions. Communicative acts included *initiation, imitation*, and *response*. Ben rarely initiated communication, but did imitate the clinician and respond to prompts and questions from the clinician at a variable but more consistent rate. In two sessions, imitations composed more than 50% of Ben's utterances, and during both of those sessions, Ben's disruptive vocalizations significantly decreased. This result could suggest that if Ben's disruptive behavior was decreased and his engagement increased, he would be more likely to communicate in the session. This could lead to a better opportunity to learn and use new words.

INSIGHTS FROM FINDINGS

This next section will provide some insight into why the results found occurred in this study. Some possible confounding variables will also be discussed.

Measurement of Communication Modalities

Findings from initial studies of MCT found that the clients who already had a semantic representation of the target words were more successful at using multiple modalities to communicate those targets (Wallace & Purdy, 2011). Ben did not have accurate semantic representations of the words presented in intervention sessions prior to the study. For this study, the clinician was attempting to teach Ben new words, however, MCT is currently a treatment used to provide adults with aphasia after stroke communicate words in multiple forms (Wallace & Purdy, 2013). The thought behind the treatment is that adult clients have lost the ability to access language that they already established pre-morbidly. This intervention approach may not be as effective for a child with ASD such as Ben, who is still developing language and does not already have semantic representations of the target words. Tager-Flusberg (1985) wrote about the possibility that children with autism cannot easily form semantic concepts, which could lead to difficulty acquiring new words.

During baseline period, Ben was presented with the probe task of labeling the ten target words used in the intervention. Ben inaccurately labeled the ten words during baseline period. Throughout the study, many of his labels remained rigid despite being taught the words through the intervention tasks provided. For example, Ben labeled the word “sweater” as “shirt” and did so consistently throughout the intervention period. He

labeled “watch” as “clock” consistently as well as the word “street,” which he labeled as “outside.” These seem to be examples of *overextensions*, where a child uses one label for several semantically similar words (Paul & Norbury, 2012). Overextensions are a typical feature of child language, however, productive overextensions reportedly decrease between the ages of 2;0 and 2;6 (Gelman et al., 1998). Ben seemed unable to create a new label for these words that he already had a predetermined label for, despite being taught three different modalities of each word and encountering repeated examples of the words through the book and play tasks. These words were both taxonomically related and unknown words to Ben, which are two common features of words to which children tend to overextend, according to a study by Gelman and colleagues (1998). The inaccurate semantic representations that Ben seemed to have for some of the words were difficult for him to change. More research in this area of word learning is needed, especially with children with autism.

Measurement of Communicative Nature of Utterances

The child who participated in this research study generally vocalized non-communicative utterances at a greater rate than communicative utterances. The majority of the communicative utterances Ben produced were imitations and responses. He initiated very little consistently through the intervention period, indicating that he has limited communicative intent. An adult with aphasia who engages in MCT as a part of their treatment after a stroke may express a desire to return to their previous level of

functioning. A child with ASD who has limited communicative intent may not be a good candidate for MCT, as the goal of the treatment is to establish the use different modalities to communicate a message with a listener. Further research on the use of MCT with children may focus on children who have a wider communicative profile and initiate more, but experience more communication breakdowns with their listener. MCT could potentially be used as a repair strategy in these situations.

Measurement of Challenging Behaviors

Findings from the present case study indicated that challenging behavior presents a barrier to the effective execution of MCT. Ben, a child with autism spectrum disorder, presented with challenging behaviors, such as crying and flopping, which were present the majority of one-minute intervals throughout each intervention session. These behaviors limited Ben's ability to sit down and work with the researcher, which is an important part of executing MCT (Wallace & Purdy, 2013). Ben's limited attention also caused the researcher to need to redirect him frequently. While challenging behavior can occur when working with adults post-stroke as well, the effect of challenging behavior on the effectiveness of MCT as an intervention has not yet been reported.

Study Limitations

Some caveats of the present study include the procedures of the treatment, attention and behavior of the participant, and various time constraints, which may have hindered effective intervention.

Multimodal communication treatment (MCT) is a fairly new treatment for adults with aphasia. As such, little research has been conducted studying its effectiveness and, according to the authors of its pilot study, the treatment procedures have not been specified (Wallace & Purdy, 2011). In the initial study, participants were presented with a target and asked to brainstorm different ways to communicate the target. This procedure assumes that the participant has a semantic representation for the target and can attend to the task of engaging with the clinician by brainstorming alternate modalities to communicate the word.

The present study of a child with autism modified MCT treatment by teaching novel words to the participant and gradually attempting to teach different modalities to communicate the word, rather than starting with all modalities at once. The purpose of this approach was to add multiple baselines to the treatment to test if adding new modalities would improve Ben's ability to learn and accurately label the words. This strategy was not effective for Ben within the time limits of this pilot intervention and may not be an effective way of executing MCT with children who are diagnosed with ASD and do not have an established semantic repertoire.

Ben's attention varied greatly throughout intervention sessions. He frequently exhibited self-stimulatory and escapist behaviors in the same one-minute interval where he displayed engagement. The inconsistent nature of Ben's attention contributed to the challenge of executing the intervention. The tasks provided by the clinician for the intervention were executed with limited attention and constant redirection as Ben had difficulty overcoming distractions to engage in the activity. The intervention tasks were planned according to Ben's interests in order to engage him in therapy, however, Ben still preferred to engage in challenging behaviors and resisted engaging in activities with the clinician. Ben also exhibited limited eye contact, which can prove challenging for introducing the other modalities of communicating words besides speech. Ben rarely watched the clinician, making it difficult to learn manual signs or the accurate use of the Dynavox.

In addition of the role of attention in executing tasks, time was another constraint to the study. Ben was absent for four sessions throughout the intervention period, which not only provided less time for the intervention, but also created a larger time lapse between intervention sessions. This gap of time between sessions could be a barrier to learning new words if they are not being reinforced regularly. The length of sessions was also limited. Sessions were designed to be 20 minutes in length, however, Ben arrived for some sessions late and had difficulty both walking back to the therapy room and struggled to attend to tasks. This led to limited time to execute the intervention. These

time constraints may have all contributed to the ineffectiveness of the intervention with this particular child.

CHOICE OF INTERVENTION APPROACH

MCT may not be an effective approach for word learning in children with autism. It may be more useful as a communication repair strategy for children or adults who have limited verbal output but have an age appropriate level of communicative intent. Children who exhibit breakdowns in intentional communication when the listener does not understand the original message may need a repair strategy, or alternate means of communicating in order for the message to be understood and the desired outcome to be achieved. MCT may be a useful repair strategy and further research should be conducted with appropriate populations.

Ben is a child with ASD who exhibits limited spontaneous communication. Although he rarely initiates communication with others, he prefers to use the spoken word modality when communicating. Speech and language therapy should focus on functional communication goals for Ben to increase his productive use of spoken words when interacting with peers and adults. Clinicians should continue to plan naturalistic interventions for Ben tailored around his interests. In addition, Ben would benefit from additional behavioral goals, as his challenging behavior is currently serving as a barrier to effective intervention practices.

DIRECTIONS FOR FUTURE RESEARCH

MCT was not an effective intervention approach for this child with ASD as improvement in measured variables was not observed. Ben was operating at a younger developmental language level and was limited in communicative output relative to expectations for his chronological age. In addition, he was largely unmotivated to communicate in therapy sessions and exhibited a variety of challenging behaviors. These behaviors included tantrums and other escapist behaviors as well as repetitive and stereotypical behaviors. Further studies of MCT with a child who initiates more spontaneous communication but experiences communication breakdowns may be a topic of future research.

More research is needed to investigate effective word learning intervention for children with ASD who have limited communication output. In addition, further research should be conducted around the role of challenging behaviors in intervention and effective ways to reduce these behaviors in children with ASD in order to increase the child's attention in intervention tasks so that communication and language goals can be more effectively targeted.

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