

SYSTEMATIC REPLICATION OF STANDARD MAND TRAINING
WITH ADULTS WITH INTELLECTUAL DISABILITIES:
ACQUISITION, GENERALIZATION, AND
MAINTENANCE

by

Jarrold C. Vaughan

An Abstract

of a thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science in Behavior Analysis and Therapy
in the School of Nutrition, Kinesiology, and Psychological Science
University of Central Missouri

January, 2019

ABSTRACT

by

Jarrold C. Vaughan

Applied behavior analysis (ABA) is the most effective intervention used to establish a verbal repertoire among children with autism spectrum disorder (ASD; Bowen, Shillingsburg & Carr, 2012; Michael, 1988; Hall & Sundberg, 1987). A significant amount of research examining mand training with children with ASD has been conducted; however, the generality of mand training to different populations has not been examined. The current study was a systematic replication of standard mand training used with children with ASD aimed at determining the extent to which it was generalizable to adults with intellectual disabilities (ID). Four adults with ID, between the ages of 43 and 56 and with moderate to severe intellectual disability, took part in the study. A multiple probe across subjects research design to was used to demonstrate a functional relation between mand training and trials to criterion and percentage of correct mands. Acquisition of manding occurred relatively quickly using standard mand training, with generalization of performance observed. Manding procedures, and intervention outcomes were rated as highly acceptable. Results were maintained at six-week follow-up.

Keywords: mand training, generality, systematic replication, intellectual disabilities

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ACKNOWLEDGMENTS

I would like to thank Dr. Duane A. Lundervold for his guidance and continued support throughout the course of this research, as well as my thesis committee for their patience and support during this process. Thank you to my fiancé Wendy for being so patient with me (and helping me keep my sanity) throughout the entire process. I would also like to thank my secondary observer, Alyse Faller, for her assistance in data collection throughout the course of this project, as well as all guardians and staff involved with the participants' care. Thank you for all that you do and thank you for the commitment you showed during this research.

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CHAPTER 1 NATURE AND SCOPE OF THE STUDY

Skinner (1957) first defined the verbal operant as a behavioral unit that is similar in form, and functionally related to several independent variables (Finn, Miguel, & Ahearn, 2012). There are many components of verbal behavior; however, the core verbal operants are mands, tacts, intraverbals, and echoics. In recent years, several behavior analytic interventions based on these verbal operants have been established as effective treatments for individuals with inadequate verbal repertoires; most notably, individuals with autism spectrum disorder (ASD). As such, an extensive literature on verbal behavior has emerged within the behavior analytic literature. Many interventions used to establish verbal behavior involve the manipulating motivating operations, in this case, establishing operations (EO). An EO is a distal environmental condition that momentarily alters reinforcer effectiveness for certain events, and momentarily alters the frequency of responding that has been reinforced by those events (Michael, 1988). In mand training related to accessing reinforcing events, the precise EO used is deprivation, which refers to a state in which the organism is deprived of a stimulus for a certain amount of time and as a result, it may function as a more powerful reinforcing stimulus (Cooper, Heron, & Heward, 2007). The role of EOs is crucial in the development of a successful manding repertoire.

There is a large literature describing interventions used to establish a verbal repertoire among children with ASD. Unfortunately, the growth of verbal behavior interventions for children with ASD has resulted in a corresponding neglect of the application of this technology to other populations with deficits in verbal behavior, for example, intellectual disabilities (ID) and traumatic brain injury (TBI). In addition, the generality of interventions used to establish

verbal behavior has not been examined in these populations. Consequently, very little information is available regarding whether standard verbal behavior intervention procedures will be effective and beneficial.

Early intervention related to ASD is another aspect that is limiting opportunities for other populations to benefit for effective treatment. Those children with ASD and that have health care coverage for Applied Behavior Analysis (ABA) services have access to treatment fairly early in their lives. However, individuals with ID, TBI, and other developmental disabilities have been left behind with respect to insurance-covered behavioral health care. Manding is a staple of early learning among all verbal children, and as a pivotal response it is related to the acquisition of a more complex verbal behavior. With manding an individual can access more reinforcers, and, ultimately, have a better quality of life. As a result of the lack of research on verbal behavior among individuals with ID and TBI, these individuals have fewer opportunities to live independently and have the same quality of life as other disabled populations that have benefited from early and prolonged verbal behavior intervention. Furthermore, it remains unclear whether the same verbal behavior intervention used with children with ASD can be used with adults with ID.

Purpose and Thesis of Study

The purpose of this research was to systematically replicate standard mand training procedures used with children with ASD to determine the extent to which it was generalizable to adults with ID. The study sought to answer four questions; 1) does replication of standard mand training result in the acquisition of mands by adults with intellectual disability, 2) do the mands acquired result in generalized performance in the natural environment, 3) were the outcomes obtained socially valid, and 4) was performance of the mands maintained six weeks post training.

This study hypothesizes that replication will result in mand acquisition, mands will generalize to the natural environment, obtained outcomes will be socially valid, and mands will maintain six weeks post-training.

Procedural Overview

Four adults, between the ages of 43 and 56-years-old with moderate to severe intellectual disability, took part. Standard mand training procedures used with children with ASD were employed to establish sign language requests (mands); (Bowen, Shillingsburg & Carr, 2012). Participants received training in their State of Missouri, Department of Mental Health supported home. The sign language repertoire of the participants was limited to 2-3 manual signs. The generality of training was examined by assessing the percentage of correct mands across examples, and trials to criterion. A multiple-probe across subjects research design, a variation of the multiple-baseline design, was used to demonstrate a functional relation between mand training and response accuracy and percentage correct. Data were analyzed using visual analysis of the trend, level, variability, stability, and overlap of the data. A multiple baseline design involves collecting data on one behavior for two or more participants. After a steady state of responding was obtained in baseline, the independent variable was manipulated for the first participant, while the remaining participants continued in the baseline condition. Once a steady state of responding is observed for the first participant (i.e. the data are stable and consistent indicating a functional relationship between the manipulation of the independent variable and responding), the independent variable is manipulated for the second participant. Thus, the independent variable is manipulated in time-lagged fashion and continues in this manner for each participant (Lundervold & Belwood, 2000; Cooper et al., 2007). A functional relation is

demonstrated when the target behavior systematically increases or decreases contingent on the manipulation of the independent variable.

It has been demonstrated that the EO deprivation plays a critical role in the acquisition of positive reinforcement-based manding skills. Deprivation, as previously stated, refers to a state in which an organism has been deprived of a stimulus for an amount of time and as a result, this stimulus becomes more effective as a reinforcing stimulus (Cooper et al., 2007). Therefore, utilization of an effective reinforcer in mand training is of paramount importance. Preference assessments were conducted to determine what stimuli may function as reinforcers for the participants. A multiple stimulus without replacement (MSWO) preference assessment was conducted with each participant. An MSWO preference assessment involves presenting an array of stimuli and allowing the participant to choose the preferred item. Once the item is consumed or manipulated for a pre-determined amount of time, the item is removed. This procedure was repeated until there were no items left in the array. While effective reinforcers are necessary for mand training, so are basic motor skills.

Manual sign training was then implemented. Each participant was shown a nonsense manual sign associated with each preferred item, and was then be asked to demonstrate or emit the manual sign. Nonsense manual signs (mand responses) consisted of very simple hand movements (i.e. making a fist, touching two fingers together, etc.). Training continued contingent on reaching a training criterion of 100% accuracy across five consecutive trials for the current manual sign under training. Correct responding was reinforced or corrected based on responding. Mand training was conducted following manual sign training.

During mand training, the participant was presented with a highly preferred item and queried, "What do you want?" If the participant responded with the correct manual sign,

reinforcement was presented. Incorrect or delayed responding was corrected through feedback, modeling, and hand-over-hand guidance. After mand training had occurred, generalization probes were conducted using staff members who regularly worked with the participants in their homes. Staff were taught to present the S^D for manding (i.e. asking the participant, “What do you want?”) and reinforced correct responses. Staff fidelity of implementation of the procedures was scored with contingent feedback being presented. Following this training, staff completed a structured social validity questionnaire to evaluate to what extent they believed the results obtained were meaningful.

Social validity is the extent to which the goal of treatment is appropriate and acceptable, and changes in the target behavior are meaningful (Cooper, Heron, & Heward, 2007). Social validity data is normally provided by those who have regular contact with the individual in their everyday life (i.e. parents, teachers, staff, stakeholders). This is an important aspect of any psychological intervention and was measured using a questionnaire presented to staff at the conclusion of the generalization assessment. Another important outcome measure in behavior analysis and therapy is durability or maintenance of responding.

Maintenance probes were conducted two weeks after the conclusion of mand training and the generalization assessment to assess the extent to which the manding repertoire continued to be demonstrated under the appropriate stimulus conditions. As in the baseline condition, the S^D was presented, and responses emitted were recorded accordingly.

CHAPTER TWO REVIEW OF THE LITERATURE

OVERVIEW OF MAND TRAINING

While interventions aimed to increase the verbal repertoire can be used in numerous situations and populations, the focus of verbal behavior interventions has been on children with autism. Communication deficits are characteristic of children diagnosed with ASD, with limited communication often related to the occurrence of problem behaviors (Nigro-Bruzzi & Sturmey, 2010). Due to the increasing number of individuals with ASD and the relationship between communication skills and success in school, community, home and vocational settings, verbal behavior interventions are needed more than ever before. Researchers and clinicians have taken this challenge in stride; verbal behavior interventions are now one of the most common behavioral interventions used in treating children with ASD. While there is no general consensus on the percentage of children with autism with communication problems, most experts agree on a prevalence of at least one child with ASD per 88 typically developing children, the majority of which present problems with communication (Mody & Belliveau, 2013). Considering that children with ASD often have these difficulties, a common type of verbal behavior intervention focuses on the mand (Cooper, Heron, & Heward, 2007).

“Mand” was coined by Skinner in 1957 and originates from terms such as “command,” and “demand.” A mand is a verbal operant which is reinforced by a consequence specific to that situation and is under the functional control of the environmental conditions of either deprivation or aversive stimulation (Michael, 1988; Skinner, 1957). Essentially, a mand can be thought of as a request, though less formal than an actual command. If a speaker requests something from a

listener and the listener has given the speaker what they requested, it can be said that manding has occurred. Manding is an essential aspect of language development and, as such, is often the target of verbal interventions due to the fundamental need for manding in an adequate verbal repertoire. The mand is one of the first pivotal verbal operants acquired by a child (Cooper et al., 2007). For example, a discussion with a child (and subsequent parent interview), along with naturalistic observations, indicates that a child's favorite color is blue. After conducting additional observations of the child in his home, it is found that playing with toy cars is reinforcing for him; the child plays primarily with blue cars. The preferred reinforcer for this child could be a blue car. In the presence of the S^D , the question "what do you want?", if the child says, "blue car," the blue car would be presented. If the child does not say "blue car" or makes any other utterance, the reinforcer is not delivered. In this example, the mand is the child saying "blue car," and the consequence would be the presentation of the blue car. Deprivation would have a role in this example if the child has not played with a blue car during a certain period of time, which would increase the effectiveness of the car as a reinforcer.

Relevant Topics

Several studies have examined the role of verbal behavior in children with autism and developmental disabilities, encompassing a wide variety of topics such as emerging speech, verbal resurgence, and staff training for these individuals (Berg, et al., 2015; Drasgow, Martin, Chezan, Wolfe, & Halle, 2016; Kelley, Shillingsburg, Castro, Addison, & LaRue Jr., 2007; Loughrey et al., 2014; Nigro-Bruzzi & Sturmey, 2010). There is also research demonstrating the generality of mand training. For example, Lee, Luke, and LeePark, (2014) examined mand training in two typically developing female infants to determine the effects on vocalization rates. Mimi was four months old, and Anna was five months old; both children could orient to sounds

and would sometimes smile or laugh when interacted with. Baseline consisted of not attending to the infants' vocalizations in any way. During intervention, mand training sessions were implemented using food presentation contingent on vocalizations, followed by differential reinforcement of other behavior (DRO) as a control. During mand training, the researchers communicated with each other and occasionally talked to and smiled at each infant. If the infant made a vocalization during researcher engagement, the mand was counted as correct and the reinforcer was presented. No specific mands were targeted during this study. During DRO, the researchers engaged in conversation with each other and looked and smiled at the infant. If the infant was quiet during this exchange for 5 s, reinforcement was delivered. If the infant vocalized during the 5 s interval, the timer was immediately reset. Results indicated that during baseline, vocalizations per minute averaged one vocalization for Mimi, and 0.67 for Anna. During the first mand training phase, vocalizations per minute averaged five vocalizations for Mimi, and three vocalizations for Anna. The first differential reinforcement phase averaged roughly 1.5 vocalizations for Mimi, and 0.13 vocalizations for Anna. Results were similar during the second mand training and differential reinforcement procedures. These results indicate that a difference in vocalizations per minute was observed in the mand training condition versus baseline and control conditions. These results extended research on pre-word language development regarding the effectiveness of mand training (Lee, Luke, & LeePark, 2014).

Shafer (1994) reviewed several studies related to mand training to determine what types of procedures were being used to establish the mand. Incidental teaching, choice, and the interrupted behavior chain were the three procedures examined. Each of these interventions was implemented in the learners' natural environment. Houghton, Bronicki, and Guess (1987) examined mand training in relation to incidental teaching for 37 children in public schools,

institutions, and university sites, along with 48 staff members working with these individuals. Results indicated that staff did not respond to student-initiated mands. However, staff-initiated opportunities for manding were more prevalent in the new-born to five-year-old age range. Additional results of this study indicated that staff and learners had vastly different communication methods (e.g. sign language, single-responses, etc.). These findings indicated that staff need to be able to identify the wide topography of manding and must also be vigilant in observing variations of mands throughout the day. Prompting mand elaboration and providing specific reinforcement are additional suggestions when teaching manding using incidental teaching.

Sigafoos and Dempsey (1992) reported inconsistencies in manding when choice procedures were used. Children participating in the study were provided five opportunities to choose a food or beverage. Results indicated that the participants would often refuse the item chosen (with one child refusing the chosen item 19% of the time). An additional condition was then implemented in which the item not chosen was given to the participant, which resulted in the child often accepting this item. Based on this study, it is likely that the EO for manding the “preferred” item was not in effect (Shafer, 1992). Conversely, the acceptance of the item not chosen may have been due to the EO being in effect for both items. It is also possible that an observing response made by the subject was responded to as a mand by the researchers thus resulting in refusal of the item given to the person. Additional procedures using choice procedures have included using switches to teach selection-based mands to children with ID and combining choice into an incidental teaching treatment package.

MAND TRAINING (MT) PROCEDURES

Oftentimes, children with ASD and other developmental disabilities do not acquire appropriate language skills early on, resulting in limited functioning in aspects of independent living (e.g. self-care, skill development, etc). An inadequate verbal repertoire can also result in under-employment, unemployment, limited educational opportunity, and social stigma. Over the last 20-years, behavior analysts have investigated procedures that can be used to establish a verbal repertoire in non-verbal or minimally verbal individuals (Bourret, Vollmer, & Rapp, 2004; Esther, 1994; Bowen, Shillingsburg, & Carr, 2012; Nigro-Bruzzi, & Sturmey, 2010; Albert et al., 2012). Verbal behavior is defined as behavior that is reinforced by another person's behavior (Skinner, 1957). Thus, any vocal/verbal or motoric action included in a social interaction can be considered verbal behavior.

Standard Mand Training

The starting point for establishing a verbal repertoire typically is mand training, with the mand often being one of the first verbal operants acquired by a child (Bijou & Baer, 1965; Cooper et al., 2007). Various mand training procedures have been developed and evaluated; however, three essential independent variables are manipulated to establish a mand: (a) response prompting, (b) response prompt fading, and (c) differential reinforcement (Cooper et al., 2007). In mand training, the trainer will present the discriminative stimulus (S^D) paired with a verbal prompt: "What do you want?" If the participant engages in the appropriate mand response, a reinforcer is delivered.

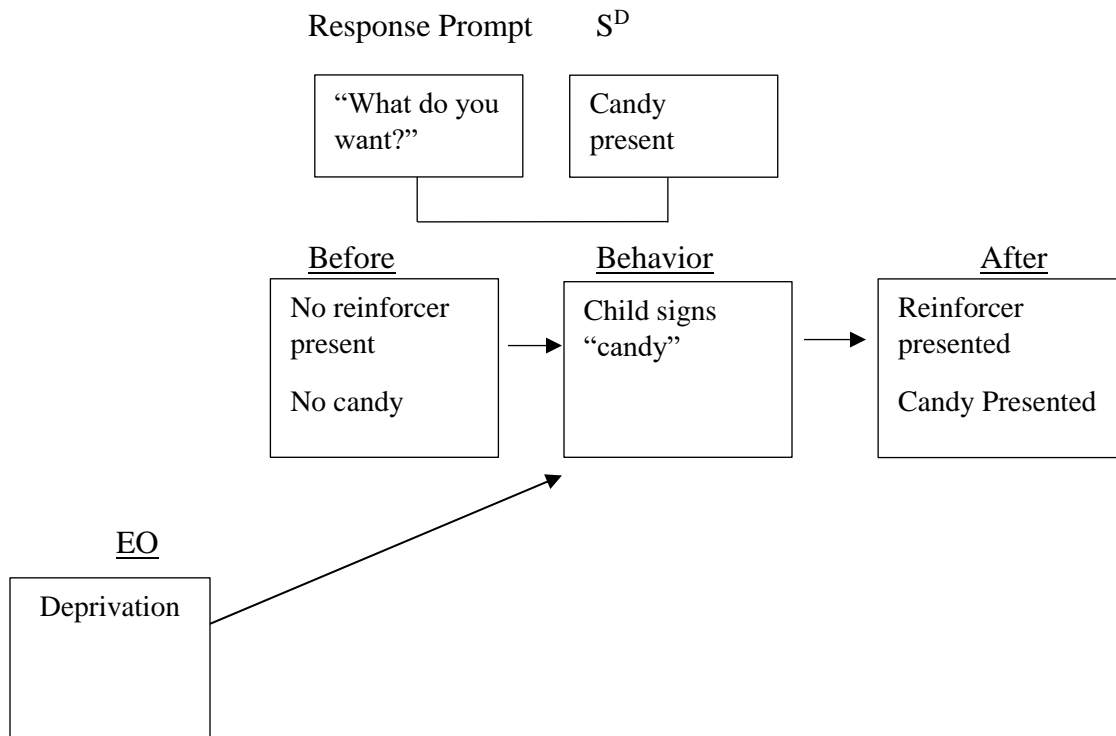


Figure 1.1: Example of basic mand training procedure

Figure 1.1 provides an example of a basic mand training procedure excluding differential reinforcement and error correction procedures. In order to be effective, mand training requires the inclusion of differential reinforcement and error correction procedures. The differential reinforcement procedure involves the model in Figure 1.1, and error correction procedures to increase the likelihood of correct responding and density of reinforcement. Incorrect responding is always on extinction.

Elaborated Mand Training

Figure 1.2 illustrates a differential reinforcement procedure comprised of reinforcing the correct manding response, while placing on extinction the incorrect manding response or an absence of responding. In the event of incorrect responding, an error correction procedure would

be implemented after the child emits an incorrect mand. For example, after the instructor asks, “what do you want?” the child might sign “soda.” When this occurs, the instructor should say “no, this” and model the correct sign. The instructor should then verbally prompt the correct

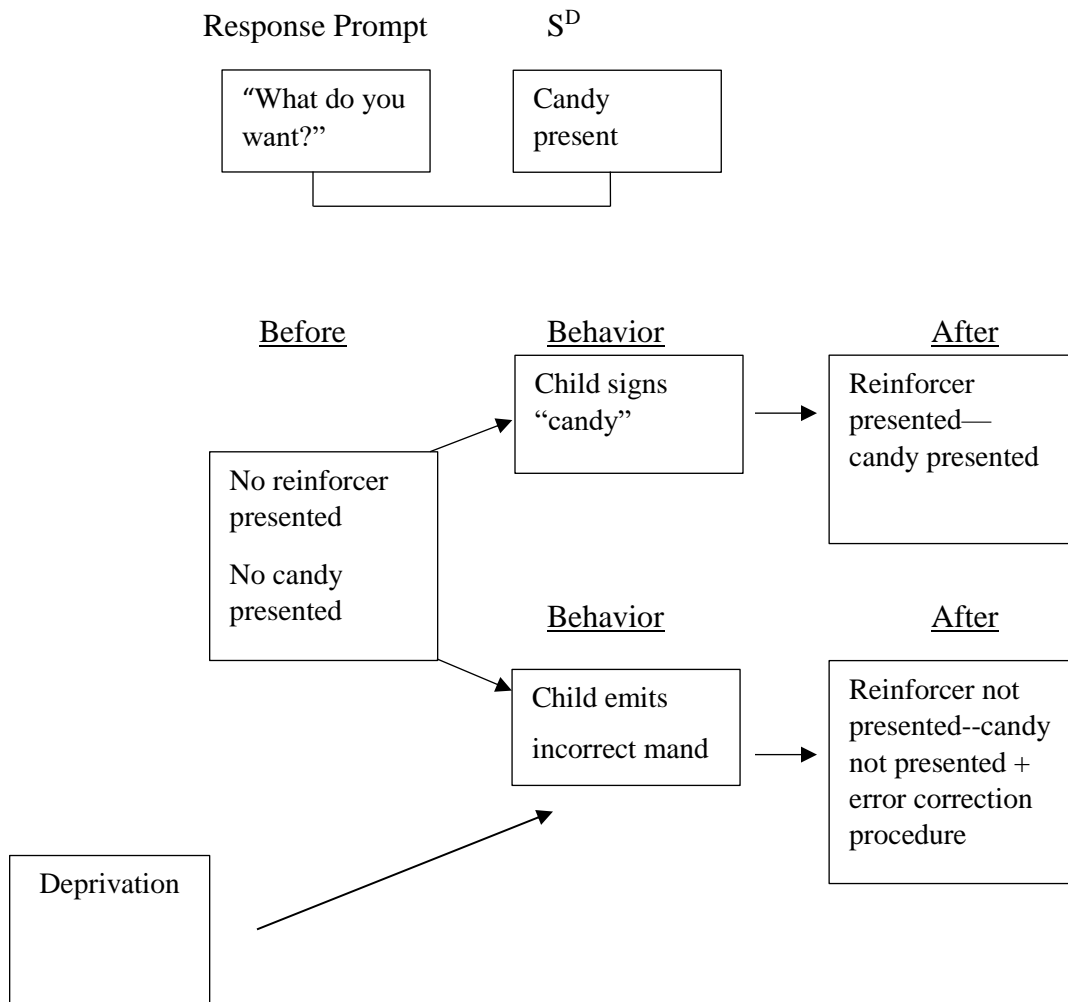


Figure 1.2: Example of elaborated mand training

response by saying “now you try.” If the child does not emit the correct mand, the instructor.

verbally states “Let’s try it a different way” and provides hand-over-hand guidance to emit the correct mand. The instructor then provides reinforcement for the completion of the correct sign

Mand training relies on the presentation of response prompts. However, the use of response

prompts may also cause an undesirable behavior to occur, and, therefore, may function as aversive stimuli (Bowen, Shillingsburg, & Carr, 2012). Response prompts are still heavily used despite the risk of disruptive and aggressive behavior simply due to their pivotal relationship to the establishing operation (Sundberg & Michael, 2001).

Fading of the response prompts is a crucial component of mand training in order to transfer control of responding to the establishing operation and relevant discriminative stimuli. This is usually done by fading the verbal prompt (either altering frequency or delaying the prompt itself), and then fading the nonverbal discriminative stimulus (S^D). The S^D sets the occasion for the mand given an adequate state of deprivation (EO) relating to the stimulus (Cooper et al., 2007). If an instructor is teaching a child to mand for soda, then the can of soda being presented would function as the discriminative stimulus. Fading of the discriminative stimulus ensures that the mand comes under the control of the motivating variable. Additional procedures have been used in mand training as well including modeling, instruction, and response feedback (Nigro-Bruzzi & Sturmey, 2010).

The starting point for many mand training procedures is using verbal prompts. Verbal prompting is the most common procedure used to enhance the EO of deprivation. In the absence of the S^D a verbal prompt may function as an S^D by signaling the availability of reinforcement and thereby setting the occasion to engage in a response that will be reinforced. Verbal prompts having a deprivation enhancing effect have also been examined. Bowen et al. (2012) examined the effects of the question “what do you want?” on mand training outcomes of children diagnosed with ASD. The question was asked of two children and the results were compared against not asking the question. The results of the study indicated that there was no major difference between the two conditions. The use of the question “what do you want?” along with

other verbal prompts has been discouraged by some due to the possibility of undesirable behavior. However, results of this study indicated no such threat. Despite this finding, replications are needed encompassing more participants to verify these results. Kelley, Shillingsburg, Castro, Addison, and LaRue Jr. (2007) also examined mand training using the question “what do you want?” to prompt a mand response in three male children with developmental disabilities. Steve, a 10-year-old child with ASD would occasionally emit one-word utterances. Tyler, a 3-year-old, diagnosed with general language delays, frequently emitted 2-3 word utterances while 3-year-old Ed suffered from apraxia and regularly emitted 1-word utterances. Each participant was also trained to tact (which can be thought of as a label for a stimulus; e.g. the small car where small is the tact) in order to assess response generalization across verbal operants and their functional independence.

The participant was presented with a stimulus, e.g., a shoe, followed by “what is it?” The results indicated that mand and tact training themselves were effective with the use of a response prompt; “what do you want?” for manding and “what is it?” for tacting. Each participant engaged in high levels of mand and tact responses following training with each verbal operant. Results also indicated that mand and tact responses did generalize across verbal operants. For Steve, three tacts generalized to manding, while one mand generalized to tacting. For Ed, two mands and one tact generalized across verbal response classes, while three of Tyler’s responses generalized across response classes. In regards to functional independence of verbal operants response classes, results were consistent with previous research, and indicate the importance of verbal repertoire assessment prior to any verbal behavior intervention. While Bowen et al. (2012) and Shillingsburg et al. (2007) examined the deprivation enhancing effect of a particular verbal prompt, little is known about whether other specific verbal prompts serve the same function.

However, there have been several studies that have incorporated verbal prompts during mand training, as they have been shown to be essential for successful mand training (Albert et al., 2012; Bourret, Vollmer, & Rapp, 2004; Egan, & Barnes-Holmes, 2009; Finn, Miguel, & Ahearn, 2012; Lechago et al., 2010).

Shaping of mands

An additional component of mand training is shaping. Successive approximations of manding responses are often reinforced, especially if the learner already possesses an echoic repertoire. For example, if a child is being taught to mand for bubbles and emits the approximation “ba”, then that response can be reinforced during the onset of mand training (Cooper et al., 2007). During subsequent trials, reinforcement for emitting “ba” should be stopped (extinction) to facilitate closer approximations to the correct manding response. This process is called shaping, and the objective is to reinforce these successive approximations, then fade reinforcement while the learner gets closer to the terminal response. In order to determine whether a learner already possesses an echoic repertoire, pre-training and prerequisite skill assessments often occur. Pre-training and prerequisite skill assessments have been implemented in several studies to examine the manding skills of each participant before formal mand training actually begins. Pre-training has also been used to teach participants the behaviors they will need to engage in during mand training trials (Albert et al., 2012; Lechago et al., 2010; Bowen et al., 2012; Finn, Miguel, & Ahearn, 2012; Shilingsburg et al., 2007).

Preference Assessments

Before mand training can begin, it is important to conduct a preference assessment with participants in the study. The purpose of this step is to evaluate potential reinforcers. By

examining the duration and frequency of contact with a stimulus, the stimuli can be ranked in order of most preferred to least preferred. This relates to a fundamental fact of behavior; to ensure that the reinforcer being used is reinforcing for the participant. Several studies examined included some form of preference assessment (Albert et al., 2012; Bourret et al., 2004; Bowen et al., 2012; Finn, Miguel, & Ahearn, 2012; Lang, et al., 2012; Hartman & Klatt, 2005; Fragale et al., 2012; O'Reilly et al., 2012; Kelley et al., 2007; Schieltz et al., 2010; erg et al., 2015; Carbone, Sweeney-Kerwin, Attanasio, & Kasper, 2010; Reichle, 2008; Lee et al., 2014; Dragow et al., 2016; Tincani, 2004; Ingvarsson, 2011;

Conditioned Establishing Operations (CEO) and Behavior Chains

Manipulation of conditioned establishing operations (CEO) and the use of behavior chains have been used to teach mands. CEOs are establishing operations that alter the effectiveness of consequences due to an organism's reinforcement history with that conditioned reinforcer (Hall & Sundberg, 1987). Interrupted behavior chains have been reported extensively in the literature regarding mand training (Hall & Sundberg, 1987; Shafer, 1994). Interrupted behavior chains are procedures in which a learner is presented with the opportunity to engage in a chain of behavior; however, an essential discriminative stimulus needed to complete a response in the chain is missing and the learner must mand for that stimulus that is both the conditioned reinforcer for the preceding response and the discriminative stimulus for the next response in the chain (Hall & Sundberg, 1987).

Carter and Grunsell (2001) examined ten studies involving interrupted behavior chains. The results of each of the reviewed studies varied slightly, as no one study was identical to the next. However, the overall review identified several topics that needed to be addressed. The first issue addressed was that of the elements of interrupted behavior chains in which Hunt and Goetz

(1988) was referenced. It was stated that interrupted behavior chains required at least three steps. However, in several studies reviewed, the length was unstated or vague. Hunt and Goetz (1988) also stated that interrupted behavior chains should be used with pre-tests and cautioned at using cueing or response prompting. These components were not used consistently in the studies reviewed, leading the authors to consider revising these requirements (Duker, Kraaycamp, & Visser, 1994; Roberts-Pennell & Sigafos, 1999; Romer, Cullinan, & Schoenberg, 1994; Romer & Schoenberg, 1991b).

Efficacy of treatment was examined next, with methodological considerations for baseline interpretation being examined. In the studies reviewed, the methodology was not consistent and consisted of either prompting or the absence of prompting at the start of a sequence. Carter and Grunsell (2001) add that in light of these methodological differences, baseline methodology needs to be taken into account when examining treatment efficacy. Several studies reviewed also examined efficacy by way of acquisition and response rates. Interruption training and prompted and unprompted requests were used with the interrupted behavior chain with varying degrees of success, and lent support to the acquisition of requesting behavior and the increase in the response rate of existing requesting behavior when using interrupted behavior chains (Carter & Grunsell, 2001). The effectiveness of response prompting in interrupted behavior chains was also examined, with the ultimate conclusion being that while response prompting may be insufficient when attempting to establish new communication at the commencement of a chain, it may be required for successful implementation of the interrupted behavior chain. Target behaviors in all reviewed studies involved teaching requesting behavior. Types of interruptions were also examined in the context of natural versus contrived interruptions. Little research exists comparing natural and contrived interruptions leading Carter

and Grunsell (2001) to state that further research is needed (Alwell, Hunt, Goetz, & Sailor, 1989; Duker et al., 1994; Gee et al., 1991; Goetz, Gee, & Sailor, 1985; Hall & Sundberg, 1987; Hunt, Goetz, Alwell, & Sailor, 1986; Roberts-Pennell & Sigafos, 1999; Romer et al., 1994; Sigafos & Littlewood, 1999).

Generalization, spontaneity, and maintenance were the final topics addressed in the review. Generalization has been demonstrated in a variety of different ways including untrained missing items, communication function, and untrained routines. The spontaneity of communication using interrupted behavior chains can be described as limited due to the focus on routines (Carter & Grunsell, 2001). Alwell et al. (1989) was the only study examined in which out-of-routine contexts were described. In regards to maintenance, data were obtained in very few of the studies examined. In light of these findings, Carter and Grunsell (2001) propose several areas for future research. First, it is proposed to expand upon Hunt and Goetz (1988) and examine the relationship between perceived distress at disruption and the efficacy of the interrupted behavior chain. Comparisons of the interrupted behavior chains and other naturalistic teaching strategies would be appropriate, as well as the examination of different functions rather than requesting. Research is needed on the frequency of unplanned interruptions in natural environments and the extent to which this generalizes to situations with non-contrived interruptions, as well as the use of out-of-routine contexts. Research on the maintenance of communication skills is also required, as data relating to maintenance are very few. Further research in these areas is critical for the successful implementation of the interrupted behavior chain (Alwell et al., 1989; Gee, Graham, Goetz, Oshima, & Yoshioka, 1991; Hall & Sundberg, 1987; Hunt et al., 1986; Roberts-Pennell & Sigafos, 1999; Romer et al., 1994; Sigafos & Littlewood, 1999).

Shafer (1994) also examined several studies using interrupted behavior chains. Procedures included teaching children with physical and sensory disabilities to activate a call switch or button, preventing students from opening a door, and using gestural responding (Alwell et al., 1989; Gee et al., 1991; Romer & Schoenberg, 1991b; Sigafoos, Doss, & Reichle, 1989). These studies indicated that in order for interrupted behavior chains to be effective in teaching mands: (a) the learner must have prerequisite skills in object manipulation and task completion, and (b) the type of EO in effect may influence the outcome. These procedures do not require the targeted item to be visible as in incidental teaching. This results in the learner not being required to wait for the presentation of the item. Due to this, interrupted behavior chains appear to be the more effective intervention of the three when used alone. Incorporation treatment packages using two or more of these interventions may have alternative effects.

Hall and Sundberg (1987) evaluated mand training by manipulating CEOs and teaching behavior chains to two developmentally disabled deaf students. A behavior chain is a sequence of responses in which each response creates a stimulus change that serves as conditioned reinforcement for that response, while serving as a discriminative stimulus for the next response in the chain (Cooper et al., 2007). The reinforcing aspect of the last response in the chain maintains the effectiveness of reinforcement produced by each preceding response. Each participant was taught four behavior chains, and tested for the ability to mand the items needed in the absence of that item in order to complete the chain. Participant 1 was taught to make instant soup, open a can of fruit, clean up spilled water on a table, and operate a vending machine. Participant 2 was taught to make instant soup, open a can of fruit, make instant coffee, and color a picture. Participants were required to mand for the required items to complete the chain during a prompted tact procedure. The missing item was presented if the mand response

was incorrect, contingent on which the trainer signed, “what’s that?” The participant was then required to tact the answer and contingent on the correct tact, the participant was then asked, “what do you want?” and was required to mand to gain access to the required item to complete the chain. The error correction procedure consisted of re-presenting and modeling the required mand and was repeated until the participant emitted the correct mand. Results of this study indicated that manding only occurred reliably after direct mand training, and provided preliminary support for the functional independence of mands and tacts.

Albert et al. (2012) replicated and extended the work of Hall and Sundberg (1987) by examining the use of an interrupted behavior chain procedure to determine whether it would increase the mand repertoire of children with ASD. Three children diagnosed with ASD were taught three different behavior chains involving the construction of simple structures. Once these chains were learned, the experimenter interrupted the chain by withholding one item needed to complete the chain in order to teach manding for the missing items. Results indicated that after learning to mand for missing items, the children emitted unprompted mands for missing items within established behavior chains. Manding for objects/items generalized to untrained behavior chains. Results of this study extended the findings of Hall and Sundberg (1987) by demonstrating that uninterrupted behavior chain procedures coupled with prompt and prompt fading procedures could be utilized to teach unprompted mands for missing items (Albert et al., 2012). Participants in this study were children without hearing impairments diagnosed with ASD, while Hall and Sundberg (1987) examined deaf children diagnosed with severe mental impairments. As such, vocal prompt and prompt fading procedures were used as opposed to imitative prompting procedures.

Functional Communication Training as Mand Training

A prevalent procedure used in relation to mand training is functional communication training (FCT). FCT was developed for use with aggressive and destructive behavior (Carr & Durand, 1985), and is essentially the differential reinforcement of manding in which reinforcement is presented when the mand replacement behavior occurs, and reinforcement is withheld whenever problem behavior occurs. Schieltz, Wacker, Harding, Berg, Lee and Dalmau (2010) examined manding across behavior functions, (i.e. social reinforcement, escape (negative reinforcement), and tangible reinforcement) before the implementation of FCT. The purpose of this study was to determine whether the same social reinforcers maintained destructive behavior and manding. Ten participants took part in the three-component study that targeted self-injury, aggression, and property destruction. All participants had a minimal manding repertoire consisting of single words, signing, or pointing (Schieltz et al., 2010). First, a functional analysis (Iwata et al. 1982/1994) was conducted to determine the function of each participant's problem behavior across four conditions: (a) free play, (b) escape, (c) attention, and (d) tangible. Next, independent (unprompted) manding was assessed. Finally, the correspondence between the functional and mand analyses was assessed to determine whether each was maintained under the same conditions. Results indicated that for two of the children no manding was observed in any condition. Destructive behavior was maintained by both social positive and negative reinforcement. Independent manding rarely occurred for these three children. The results of the functional analyses for the behavior of the remaining five children were equivocal. Four of these children exhibited infrequent manding. The results of this study indicated that manding and destructive behavior were regulated by different consequences.

Berg et al. (2015) examined the opposite of the previous study by way of looking at the resurgence of manding following FCT in two experiments. Three participants, age 50, 34, and 69 years old, each diagnosed with moderate to severe ID, took part in experiment one. An ABCB experimental design was used in both experiments (i.e. FCT A, extinction, FCT B, extinction). All participants had a communication disorder and did not communicate with functional speech. During the first phase, FCT was conducted and the target mand was reinforced. Any other mand was placed on extinction. FCT was then implemented again, with only one mand being reinforced. Extinction was then re-implemented with the participants having access to only one communication board from the previous session as opposed to both boards during the first FCT session. Results from this phase indicated that both mands were maintained in the first extinction condition, though one modality was emitted more than the other. During the second FCT session, manding decreased to zero. However, a resurgence in manding was observed in the second extinction condition. The second experiment included two children, Kami and Cyrus. Kami was a 7-year-old female diagnosed with several developmental, physical, and cognitive disabilities. She exhibited aberrant behavior in the form of aggression and property destruction. Kami communicated with limited vocalizations and simple signs. Cyrus was a 3-year-old male diagnosed with a developmental speech delay and disruptive behavior disorder. He also exhibited aggression and property destruction. Cyrus communicated with gestures and non-functional vocalizations. In the second phase of the experiment, the procedure was identical to phase one, with the added difference of placing the problem behavior on extinction during all FCT and extinction sessions. Results again indicated a resurgence in manding during the second extinction session. These results lend added support to previous research in terms of resurgence of one mand during extinction of another mand from the same response class. When examining

mand training and FCT, it is important to note that while both procedures are sometimes used in conjunction, they are not the same procedure. In FCT, once an incorrect response is emitted, extinction is applied, no reinforcement is presented, and another session begins. In mand training, the focus is on training the manding repertoire of a participant. If an incorrect response occurs, an error correction procedure is implemented to ensure that the participant emits the correct response, which is then reinforced. When using mand training and FCT together, it is important to differentiate between the two in order to implement each procedure correctly. It is also important to note that FCT functions as a differential reinforcement of alternative behavior procedure (DRA). As such, FCT involves reinforcing an alternative behavior that serves the same function as the problem behavior, while placing the problem behavior on extinction.

Additional Effects of Mand Training

Interestingly, there are situations that arise in which an individual taught to mand begins to emit separate untrained verbal operants during the course of mand training procedures. Egan and Barnes-Holmes (2009) examined the emergence of untrained tacts following mand training (response generalization). Four young boys between the ages of five and seven and diagnosed with ASD took part. In baseline, two pre-experimental probes were conducted to test for the occurrence of a vocal mand and tact repertoire. Mand training was then conducted in which the experimenter placed a preferred item in front of the participant in a small bowl. The topography of the correct mand was use of an adjective, (i.e. “I want small.....”). The item was delivered contingent on correct responding. If an incorrect response occurred, the correct response was vocally modeled and the participant was prompted to imitate. If the participant did not imitate the correct response, the item was removed, and training was stopped for that item. Post-mand training probes were conducted to test for tact emergence by placing an item in a bowl to

occasion the adjective tacting. Tacting responses were counted as correct if the response included “it is small.”

In phase two, a response prompt for tacting was used by adding “what is this?” prior to mand training. After mand training, three of the four participants displayed no tacting responses, while one demonstrated modest response generalization (33%). In phase two no response generalization (tacting) was observed for 75% of the trials. One participant, however, did display response generalization (tacting) during both phases. Results indicated that response generalization (the occurrence of untrained tacts) is not likely to occur as a result of mand training.

Response Generalization of Mands

Response generalization of mands may occur as a result of tact training. Finn, Miguel, and Ahearn (2012) examined the emergence of untrained mands and tacts among four boys, between the ages of three and six-years-old and diagnosed with ASD. All participants attended an early intervention program. Three of the four were reported by teachers to frequently engage in mands and tacts. Each participant was assessed for prerequisite skills and a preference assessment was also administered. Two were taught to mand, and two were taught to tact following a pre-training procedure. During pre-training, participants were taught to complete two different construction tasks via backwards chaining. Pieces were presented and the experimenter stated “put them together.” Prompting began using hand-over-hand guidance faded to light physical guidance followed by a two second delayed physical guidance, and, finally, no prompting. Tokens and praise were presented contingent on correct responding. During tact training, participants were taught to tact each of the four pieces used in the construction task using least-to-most verbal prompting. This type of prompting involves using the least intrusive

response prompt (e.g. a verbal), and systematically increasing to more intrusive (e.g. hand-over-hand) prompts as necessary. During each trial, the participant was asked “what is this?”. If the participant responded with “that’s a _____” and emitted the correct verbal topography, a token and praise were presented. If the participant did not respond correctly, the correction procedure consisted of re-presenting the piece and asking “what is this?” while the experimenter immediately verbally modeled the response. No tokens or praise were presented during the correction procedure. One piece of the construction task was trained to mastery before the next piece was trained. After mastery, different pieces were presented in an alternating fashion (e.g. piece 1 and 2, then 1, 2, and 3, etc.). Mands were trained using most-to-least vocal prompting starting with full verbal to partial, time delay, and then independent performance. The experimenter presented the task with one piece missing and said “put this together”. When the participant was unable to construct the item the experimenter asked “what do you need?”, if the participant responded correctly by emitting the correct verbal topography, the item was presented. A token and praise were delivered contingent on completing the task. If the participant did not respond within 5 s, the experimenter modeled the correct response, and then implemented a correction procedure. If the participant manded for a different piece, that piece was removed from the structure and handed to the participant. A correction procedure was then implemented by prompting the correct response and repeating the trial. Mastery was identical to tact training. Results indicated response generalization in three of the four participants. These results are consistent with previous research involving typically developing children (Finn, Miguel, & Ahearn, 2012), and provide preliminary evidence for response generalization across verbal operant response classes, i.e. tact to mand, mand to tact.

Training Environments

Mand training procedures can be conducted by a teacher, parent or behavior analytic health care provider or a researcher in situ. Normally this involves the use of behavioral skills training (BST). BST (Reid and Parsons, 1995) is an instructional procedure that utilizes five components: (a) instruction, (b) modeling, (c) rehearsal, (d) reinforcement, and (e) feedback. A trainer will give instructions, which are followed by an instructor model, opportunities for rehearsal, and trainer feedback. This continues until the learner reaches a specified criterion level. In mand training, BST would involve giving the instruction (e.g. “What do you want?”) modeling the desired behavior (e.g. manual sign), rehearsing by way of the intervention procedure, and feedback in the form of differential reinforcement and a correction procedure if necessary.

Parent and Paraprofessional Implementation of Manding Procedures

Loughrey et al. (2014) examined how parents could implement mand training. Two caregivers of children with developmental disabilities were trained on eight component skills (modules) using BST. The modules were presented bi-weekly. Participants were given written instructions followed by verbal instructions with a Microsoft PowerPoint presentation incorporating models, rehearsal opportunities, and feedback. Videos imbedded in the presentation served as the behavioral model, while the trainers provided the rehearsal opportunities and participant feedback. If the participants did not meet the 100% criterion level, the video models in the PowerPoint were presented a second time, with another rehearsal opportunity being provided by the trainers: corrective feedback was presented until the level was met.

A third caregiver was then trained to implement the skills with a spouse. A multiple-baseline-across-modules design was used to evaluate the effects of the BST on each caregiver's use of the specific module skills in situ. During baseline every participant implemented each skill at near zero-percent accuracy. During intervention for the first two participants, BST increased each participant's accuracy of performing skills related to each module until the mastery criterion of 100% was obtained. During spouse training, once the trainer (Sam) reached 80% accuracy, the trainer began training their spouse (Jared) until they reached 100% accuracy. The researchers then observed Jared implementing BST with a child participant. Results indicated that after spouse training for Jared, accuracy increased from a range of 0%-40% to 67%-100%. Maintenance probes indicated that the mand training behaviors were maintained five weeks after the end of intervention for all three participants. In addition, each child's spontaneous mands increased after the intervention while prompted mands decreased. This study supports the hypothesis that BST procedures are effective in teaching parents to implement mand training procedures.

Ingvarsson (2011) examined parent-implemented framed-mand training for a child who had undergone a partial hemispherectomy. A framed-mand is a sentence rather than a single-word mand. Caleb, 4-year-old boy, who had recovered from a partial hemispherectomy, participated in the study. The mother was taught to implement the framed-manding procedure by conducting an initial pilot session in which the measurement and experimental procedures were trained. In this case, she identified basic reinforcers using a paired-choice preference assessment, and under supervision, examined whether the child could tact for the three most highly-preferred items. Baseline involved 30-second access to an item contingent on uttering a single-word mand, incomplete sentence, or a framed-mand, after which the item was removed and another mand

required. During intervention, access was contingent on only the emission of framed-mands. Framed-mands were trained using a 5 s prompt delay and echoic prompting. For example, the stimulus, candy, would first be presented. The mother would then wait for five seconds, and then present the echoic prompt, (e.g., “say, ‘can I have the candy?’”). If the child did not echo the prompt across two consecutive opportunities, immediate echoic prompting would be implemented for the next two opportunities. A mand test was implemented directly after reaching criterion to assess manding in the absence of the object. Results indicated that during baseline, incomplete sentences were Caleb’s main topography of mand. During intervention, framed-mands increased to high levels when his mother used the prompt delay and contingent presentation. However, very little generalization of manding occurred in relation to the three objects. Despite procedural errors and small levels of generality, this study provides support for the use of the BST procedures for parent training in the home setting.

BST can also be used to teach staff supporting children with ASD or developmental disabilities to implement mand training procedures. Nigro-Bruzzi et al. (2010) examined the effects of BST on the mand training of staff. They also examined the occurrence of spontaneous manding by the children involved in the study. Six children diagnosed with ASD and six staff, a special education teacher or a speech therapist, took part. The staff were paired with children by placing them in dyads. The researchers used an eight-step mand training task analysis to replicate mand training in the natural environment. During the first baseline session, the researchers gave each staff member written instructions, which included information on manding, how to train for mands, and how to take data. Each session thereafter involved a brief review of mand training including the definition, procedural implementation, and data collection. During BST sessions, the staff received 30-60 min of BST related to manding. Post-training sessions were

implemented following staff training and were identical to baseline. Generality sessions were conducted following post training to assess performance across settings. During baseline five of the six dyads showed very low accuracy in implementing mand training using the written instructions and daily review; one dyad showed an increasing trend and training was not implemented with them. Following BST and at post-training assessment, all trained dyads showed an increase in mand training accuracy, along with an increase in spontaneous manding by the children. These results lend further evidence to the utility of using BST to increase mand training accuracy of staff working with children with ASD or developmental disabilities. Both Ingvarsson (2011) and Nigro-Bruzzi et al. (2010) extend the research on BST and mand training.

Augmentive Communication and Mand Training

Mand training typically utilizes verbal prompting procedures. Verbal prompts are easy to implement, and can prove to be a very quick intervention method. However, there are instances when verbal prompting may not be sufficient to teach manding. As a result, other methods have been developed including sign language and the picture exchange communication system (PECS) (Frost & Bondy, 1994).

Manual sign language is a common augmentive communication procedure utilized in mand training, as traditional American Sign Language (ASL) gestures can easily be taught. In cases where this is not possible a symbolic motor response can be utilized as a replacement for the standard sign. Carbone, Sweeney-Kerwin, Attanasio, and Kasper (2010) examined whether the vocal responses of children with ASD and developmental disabilities would increase with the use of manual sign language and prompt delay. Three children, with no functional vocal repertoire, took part in the study. Six target items were selected based on a preference assessment conducted prior to the onset of the study. The instructor held an item at eye level to signal that

reinforcement was available. If, after 5 s the participant did not respond, the item was removed, and the next item presented. If the participant looked at or reached for the item without using the correct manual sign (or signed incorrectly), a least-to-most prompting procedure was initiated. During baseline the instructor presented the item and if the participant responded within 5 s, the item was given to the person while the instructor said the name of the object. During intervention if the participant responded, a prompt delay of 5 s was implemented. If the participant made a sound but not the sign, the manual sign was prompted, and the prompt delay was re-presented using the same procedure. Delivery of the item was contingent on the emission of a vocal or signed response. These results indicated that vocal responses increased accompanied by manual signs for specific items by using the prompt delay sequence. This study provides support for the use of manual sign language to teach manding. Results also support the use of time-delay stimulus control procedures to increase the frequency of manual signing and vocal responses during mand training.

PECS focuses on the instruction of gestural responses (pointing at pictures) related to the item or activity (Frost & Bondy, 1994). This system has seen extensive use with children diagnosed with ASD and developmental disabilities. However, there is some debate on whether PECS is more or less effective than manual signing. Tincani (2004) compared PECS with manual sign language in children with ASD. Two children diagnosed with ASD took part in the study. First, a preference assessment was conducted to identify potential reinforcers, which was then followed by an imitation assessment to determine whether the children could reliably imitate the behavior of the model. During baseline, non-contingent access to a preferred stimulus for 10-20 s was provided, after which it was removed and placed just out of the participants' reach. During intervention a picture of the object was then placed in front of each participant.

Every attempt to reach the object was blocked. If the participant touched the symbol, signed for the item, or said the name of the item within 10 s, they were given access to the item. If an incorrect response occurred the item was replaced with the next item. Following baseline, the participants were trained in both sign language and PECS. Results indicated that the first participant, Carl, emitted no mands during the baseline condition. During the intervention condition, independent mands increased to a mean of 2.1% with sign language and 17.9% with PECS. The second participant, Jennifer, emitted no mands during baseline. During the intervention condition, independent mands increased to 12.9% with sign language, and 59.6% during PECS. Preliminary results provide support for the utility of using both manual signs and PECS to increase independent mands with a higher percentage in the PECS condition. Reichle (2008) reported similar results. Both sign language and PECS are effective procedures that can be used in mand training.

Mand training can also be used to establish separate verbal repertoires in children with ASD and developmental disabilities. Drash, High, and Tudor (1999) examined the establishment of an echoic repertoire using mand training. An echoic verbal repertoire is a learner having the skills to imitate, or echo, what has just been said. For example, if a speaker says “say ‘can I go outside, please?’” and a listener imitates that verbal stimulus then an echoic verbal response has been performed. Three non-vocal children with ASD participated in the study. Through mand training the experimenters were able to establish an echoic verbal repertoire by reinforcing successive approximations to full sentences. All three of the children exhibited the acquisition of an echoic repertoire after ten sessions. In addition, two participants acquired an initial tact repertoire. This study provides further evidence that mand training can be used to strengthen or establish different verbal operants.

Procedural Concerns

While mand training can be very effective in establishing, strengthening, or maintaining an adequate verbal repertoire, there are some potential concerns that should be addressed. First is treatment integrity related to the mand training procedure. Treatment integrity (fidelity) is defined as the implementation of a procedure in the way it is designed (Pence & Peter, 2015). Mand training is effective when implemented correctly. Caregivers conduct many instances of mand training, whether that is family members, residential staff, or paid providers, e.g., Registered Behavioral Technicians (RBT). Incorrect implementation not only wastes time and resources, but also runs the risk of affecting acquisition of the mand repertoire. Pence and Peter (2015) evaluated treatment integrity errors on the acquisition of mands. One experiment examined the effects of incorrect item delivery on the acquisition of mands during mand training. Three children with developmental disabilities took part in the study. During baseline the therapist incorrectly implemented the procedure by failing to state the correct mand response. Reinforcement was contingent on correct manding. Incorrect manding or failure to respond were both placed on extinction. During training the therapist trained the nonsense name for each item according to four levels of integrity: 0%, 40%, 70%, and 100% (i.e. the extent to which the therapist implemented the procedure according to its design). For example, if ten trials are conducted with an integrity level of 70%, seven trials are implemented with the correct item while three trials are implemented with the incorrect item. If the participant emitted the correct mand, the corresponding item was given, or an unmatched item was given to test fluency errors, with a mastery criterion of 90%, or nine out of ten trials correct. Non-targeted mands or other vocal responses were placed on extinction. Treatment integrity errors were programmed into the procedure by way of a pre-determined sequence and consisted of the delivery of the incorrect

item that did not match the target mand emitted. Results indicated that the participants consistently acquired a correct manding repertoire when the treatment integrity level was 100%, but every subsequent level resulted in less consistent and less accurate manding responses.

In experiment two, the authors tested response-independent item delivery on the acquisition of mand responses. In this experiment, three children 6, 7 and 8-years-old and diagnosed with a developmental disability, traumatic brain injury, or attention deficit hyperactivity disorder/post-traumatic stress disorder served as participants. Baseline and training were identical to experiment one, however, only the target item was present throughout the sessions. The procedure for the intervention was identical to experiment one, except the target item was delivered on a noncontingent 5 s fixed-time schedule of reinforcement, with the interval commencing at the beginning of each trial. The results indicated that acquisition occurred more frequently during the 70% and 100% integrity levels for all three participants. Acquisition appeared to suffer due to the response-independent presentation of the target item at the 0% and 40% level. One participant required modified training sessions for adequate acquisition. The results of these studies validate concerns regarding treatment integrity and the importance of implementing mand training procedures with high treatment integrity.

A recent concern in the literature on mand training is whether the functional independence of mands has been empirically demonstrated. The functional independence of verbal operants has been the subject of several investigations, but reviews had never been conducted regarding just how accurately it has been portrayed during these studies. Functional independence in verbal behavior is crucial, as it assists researchers and clinicians in designing verbal behavior interventions that offer the most effective procedures and outcomes. Gamba, Goyos, and Petursdottir (2015) examined 17 studies related to mands and tacts to examine mand-

tact independence. The primary finding was that the majority of the studies examined suffered from construct validity issues. However, the review also determined that the literature, despite these problems, does provide some evidence for the functional independence of both mands and tacts.

Perhaps a more important issue is generality of the mand training procedure with respect to its application with other populations. It is well established that being able to generalize an intervention from one variable to another is a required aspect of behavioral interventions; this is no different in mand training. Examination of the previous studies indicated that all had some form of generality measure. Normally, measures consisted of generalization across staff, settings, or phases. In regard to manding for information, mand training procedures have even been generalized across establishing operations (Lechago, Carr, Gro, Love, & Almason, 2010). However, two concerns exist regarding the generality of mand training: (a) whether stimulus generalization for manding has been reliably demonstrated, and (b) the extent to which mand training procedures can be used with different populations and different ages. To date, it appears that no study has been published that has examined these concerns. With the present study, we seek to address the latter by examining the generality of mand training for children diagnosed with ASD to adults with developmental disabilities. Demonstrating the effectiveness of mand training in this population would greatly benefit the population as a whole.

CHAPTER 3 METHODOLOGY

PARTICIPANTS

Four adults with intellectual disability (ID), ranging in age from 43 to 56 years of age, took part. Each of the participants took part in a state-run community-based waiver program for adults with developmental disabilities which allowed them to live in in a community setting with at least one other housemate. Each participant was selected based on their ability to form 3-5 distinguishable signs for items or activities they desired, or to gesture to what they want. One participant (Rachel) was lost due to attrition.

Mike was a 43-year-old male diagnosed with Down syndrome. Per physician report, he functioned at the moderate range of ID. He communicated using simple sign language, facial and body gestures, shaking his head “yes” or “no”, and other forms of pre-vocal communication. He has the skill to request some items or people using simple signs (i.e. “sister” and “hungry”).

Chad was a 45-year-old male diagnosed with Bipolar Disorder. Based on the medical record, he functioned at the moderate level of ID. He communicated using one-word utterances and simple signs. He also communicated using facial and body gestures, shaking his head “yes” or “no”, and leading staff to what he wanted.

Ethan was a 44-year-old male diagnosed with ID and Bipolar Disorder and had severe ID. He communicated using simple sign language, vocal noises, gestures such as pointing and head-bobbing, shaking his head “yes” or “no”, and leading you to what he desires. He could sign for “food” or “drink.”

Rachel was a 56-year-old female diagnosed with Down syndrome and was severely intellectually disabled. She communicates using simple sign language, and could point to preferred items such as her blanket, stuffed animals, and favorite snacks. Rachel would grab someone's hand when she wants attention, and would lead staff to objects she desired.

MATERIALS AND DESIGN

Sessions were conducted in a clean area of each participants' home free from auditory and visual distractions. Sessions were conducted during times when each participant was able to be alone in the area where the training sessions were occurring to minimize distractions. The experimenter and participant sat next to one another in the area selected for training to facilitate easier procedural implementation. Each session lasted 10-15 min, and sessions were conducted three to five times per week. Each training trial was 20 s in duration. Session materials consisted of preferred items identified for each participant through a preference assessment prior to training. An arbitrary motor movement using the hands was taught that corresponded to the item being used during training. These were nonsense signs to limit the risk of exposure to sign language movements prior to the beginning of training.

Dependent Variables

The dependent variables in the study were the percentage of correct mand responses and trials to criterion of each mand. Percentage correct was determined by dividing the total number of correct mands by the total number of opportunities to respond. The mastery criterion was five consecutive correct responses at 100% accuracy. A mand was recorded as correct when the question "What do you want?" evoked the sign language motor movement that corresponded to a particular item. Correct and incorrect mands were recorded on a data sheet.

Research Design and Analysis

The vast majority of behavioral studies employ a single-subject research design. A single-subject research design is a type of research design in which the entire experiment is conducted with a single participant, though it can be replicated with other participants or behaviors (Malott & Shane, 2014). A multiple-probe across-subjects research design (Horner & Baer, 1978), a variation of the multiple-baseline design, was used to demonstrate a functional relation between instructional procedures and the acquisition of the manding responses of the participants. A multiple-baseline design is a single-subject research design in which there are baselines with differing durations and intervention start times (Malott & Shane, 2014). The multiple-baseline design is an experimental research design because, as described by Lundervold and Belwood (2000), such research designs allow demonstration of experimental control of a dependent variable based on time series and replication logic.

When using a multiple-baseline design, data are collected concurrently on each behavior of a subject or in each situation, or on the behavior each subject in each leg of the baseline. A hypothetical example of a multiple-baseline design across subjects follows. Note that in the following example, the letters A, B, and C at the top of each leg of the design correspond to a different participant and represents a multiple-baseline across subjects design.

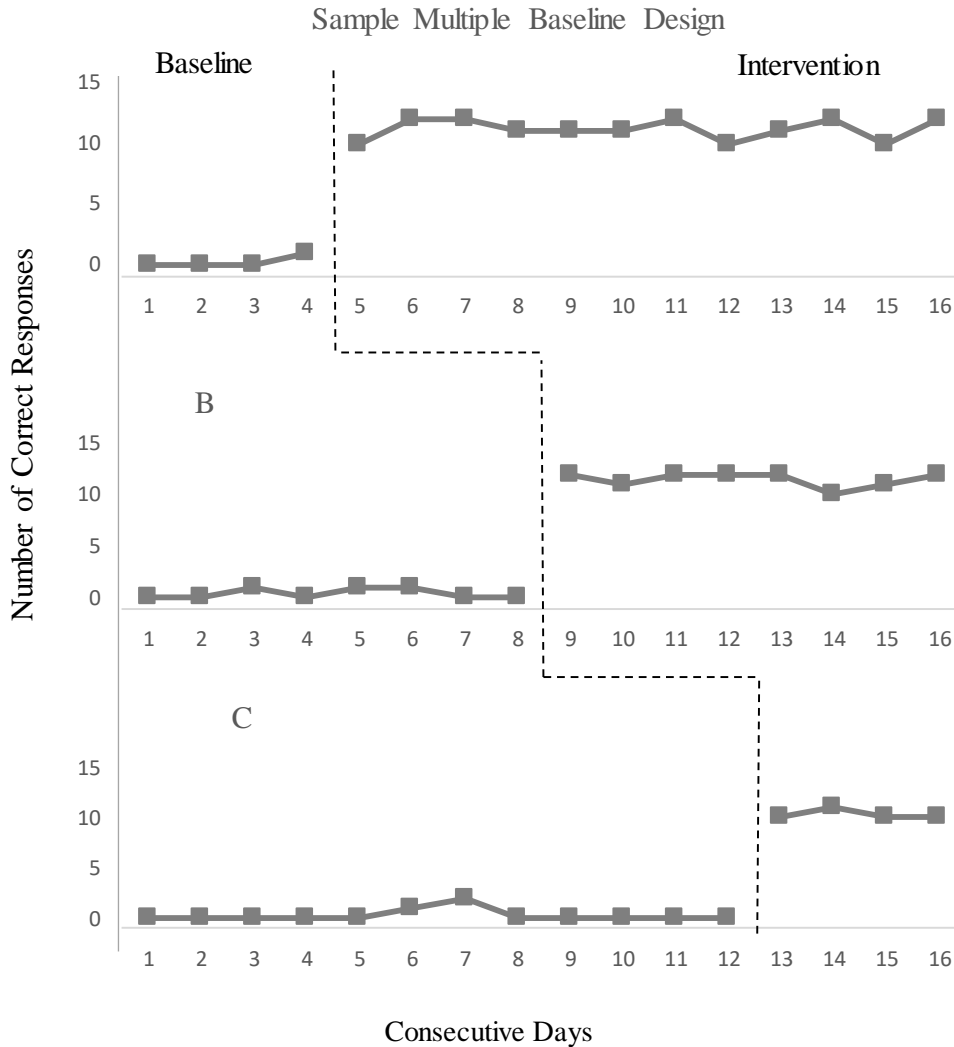


Figure 1.3: Example of multiple baseline design

Data collection continued until a stable rate of responding was observed within a baseline phase on any leg of the design. At this point, the independent variable was manipulated for only one participant, while the other participants remain in the baseline condition. Once a stable rate of responding is observed (i.e. very little variability in the data) following manipulation of the independent variable for the first participant, the independent variable was manipulated for the second leg of the design while all other legs of the design remain in the baseline condition. After

a steady rate of responding is observed following manipulation of the independent variable for the second participant, the independent variable was manipulated for the third leg of the design and so on.

Methodological Concerns Related to a Multiple Baseline Design

While the multiple baseline design has been used extensively in applied behavior analysis, cognitive behavior therapy research, and the educational literature, there are potential problems that may arise regarding use of the research design. Cuvo (1979) addresses these and provides possible solutions to minimize the likelihood of occurrence. First, is the issue of repeated assessment during the baseline condition. In a traditional multiple baseline design, participants may be in the baseline phase for a lengthy amount of time based on the rate of acquisition of previous participants which may be counter-intuitive. As Cuvo (1979) explains the longer participants stay in baseline, the more time elapses during which they are not receiving the intervention (i.e. the manipulation of the IV). Due to this situation, an extended baseline could lead to several problems. The risk of problematic behavior (e.g. self-injury, aggression, and oppositional behavior) may also increase the longer that baseline is in effect due to the baseline condition being equivalent to an extinction condition (i.e. no reinforcement of behavior). Among certain populations (e.g. individuals with ID, DD, etc.) a long history of punishment, extinction, and the lack of contingent reinforcing consequences may affect responding in extended baseline conditions (Cuvo, 1979). By using a multiple-probe design, frequent probes of behavior can be conducted without the threats imposed by continuous baseline measurement (Cuvo, 1979; Horner & Baer, 1978).

A second potential problem involves procedural contrast between training and testing (Cuvo, 1979). Rich treatment packages are often used in instructional programs in order to more

effectively occasion and change behavior. However, Cuvo (1979) argues that by using rich treatment packages, a paradoxical reduction in performance may occur. During a training phase, instruction, feedback, and reinforcement are often utilized extensively. Training is then followed by extinction, or the testing condition in which no discriminative stimuli, feedback, or reinforcement is available. This has the potential to cause a decrease in performance due to the rapid shift from a situation with a dense schedule of reinforcement with discriminative properties to an aversive one. Cuvo (1979) offers several possible solutions to this problem including determining which antecedent and consequent conditions are actually necessary, non-contingent consequences, utilizing appropriate levels of prompting, and informing participants when the condition is going to change.

Threats to Internal Validity

Internal validity is the extent to which a design eliminates confounding variables (Malott & Shane, 2014). Threats to internal validity are related to four different types of confounds: subject, setting, measurement, and independent variable (Cooper et al., 2007).

Subject confounds refer to variables involving the subject of an experiment, for example, maturation, or the change that occurs to a participant over the course of a study (e.g. physical growth, skill acquisition, etc.). Additional subject confounds may include environmental events outside of the study (e.g. events that coincide in time) and dissimilar participant characteristics. Setting confounds are variables in any given setting that may influence behavior. Because most applied behavior analysis research is conducted in the natural environment a setting variable confound can occur. Researchers cannot exert the same control over the environment in a natural setting that is possible in an analog laboratory setting. As such, natural environments are more at risk for setting confounds (Cooper et al., 2007). Another possible setting confound is the

availability of “bootleg” reinforcers, or when a participant may have access to a potential reinforcer outside of (or even within) a phase of an experiment thus affecting reinforcer strength.

The final two confounds can be examined together as measurement confounds.

Dependent variable confounds may involve observer drift (a change in the use of a measurement system over time), reactivity, and observer bias. Adequate observer training, determining inter-observer agreement (IOA), and maintaining baseline conditions long enough for stable responding to occur are both potential ways of reducing the likelihood of these confounds. Independent variable confounds typically relate to treatment integrity, which refers to the independent variable being manipulated consistently throughout a study. For example, the independent variable that is manipulated may be presented differently in the later phases of a study than it was in the beginning. Experimenter bias is also a potential threat to treatment integrity. This can occur when the researcher applies an independent variable in a way that provides deviations in the prescribed manner in which the IV is to be manipulated and is biased toward a specific condition, e.g., use of ineffective reinforcers would produce results that are biased against the reinforcement condition (Cooper et al., 2007). Methods to control for potential confounds include having precise operational definitions, simplifying and standardizing training for observers, practicing independent variable application, conducting fidelity checks, and retraining as needed. (Cooper et al., 2007; Malott & Shane, 2014). Fidelity checks, using a behavior checklist, involve a secondary observer scoring the researcher’s behavior as they implement each step of a procedure.

In single-subject research designs, the most common way to address the relevant threats to internal validity is through replication of systematic behavior change during the course of the study, and structuring the research design to rule out these threats (Kratowill, Hitchcock,

Horner, Levin, Odom, Rindskopf, & Shadish, 2010). Effect replication is typically exhibited when three demonstrations of the effect are shown at three different points in time within the same case using a reversal design, or across three different cases as in the case of a multiple baseline design. With a multiple-baseline design across subjects/behaviors/settings, replication would be demonstrated when the impact of the IV is observed across each separate leg of the design. In regards to the overall structure of the design, Kratochwill et al (2010) discusses the single-subject research design standards that should be met by any given design that will effectively rule out threats to internal validity. The first standard is that the independent variable must be systematically manipulated with the researcher determining how the conditions change. Second, each directly observable outcome measure should have IOA. Third, the study must have at least three attempts to demonstrate an intervention effect at three different points in time, or with three different phase repetitions. Fourth, each phase should have at least three data points to qualify as an attempt to demonstrate an intervention effect. By structuring a multiple-baseline design so that it meets each of these standards and demonstrates effect replication, a researcher can effectively minimize the threats to interval validity.

Visual Analysis

Visual analysis of data is the traditional method used when employing single-subject research designs (Lundervold & Belwood, 2000) and is used to identify patterns of behavior and make evidence-based decisions as a function of those patterns. There are five variables used in the visual analysis of data: trend, slope, stability, level, and overlap (Cooper et al., 2007; Lundervold & Belwood, 2000). In the visual analysis of data, each of these variables is examined separately; however, they are interdependent and the analysis of each is needed for an accurate interpretation of the data.

A trend is a data pattern characterized by the direction of the data. Trends can be increasing (trending up) or decreasing (trending down) with the behavior increasing or decreasing. Slope refers to the steepness of any given data trend. For example, consider a study in which three observations have been made in baseline (Kratochwill et al., 2010). The first observation yields a score of five, the second 15, and the third 25; the overall increase from the first observation to the third observation would indicate a steep slope. Stability is the extent to which the data remain relatively unchanged from observation to observation. The more unstable the data are between each observation, the more data that will be needed to determine steady state responding. Steady-state responding comes about after exposing a subject to experimental conditions, while controlling for potential confounds, and refraining from transitioning to another condition until a stable pattern of responding is observed (Cooper et al., 2007; Kratochwill, et al., 2010). The next experimental condition will only begin when stability in the behavior data set is observed.

A stability matrix, based on the mean of all observations, can be obtained by calculating the deviance for each observation from the mean. The deviance of each observation is squared and totaled to obtain the sum of squares (SS). The square root of the SS yields the standard deviation of the data. For the current study, a stable data series was defined as three consecutive observations with $\leq 3\%$ variability from the overall mean.

Level is the magnitude of change from observation to observation. Change in level can also be determined by comparing the last three observations of the current condition to the first three observations in the subsequent condition (Miller, 2006). Overlap is the extent to which data in adjacent conditions overlap with each other. An example of overlap would be if 5 of 10 data points in baseline overlap with those in intervention; or a 50% overlap (Lundervold & Belwood,

2000). If there is little to no overlap, i.e., 20% overlap or less, a researcher can be confident that systematic behavior change has occurred as a function of the manipulation of the independent variable. If, however, there is a high degree of overlap, then there is less confidence that the independent variable is responsible for the behavior change seen from one condition to the next (Cooper et al., 2007).

PROCEDURE

Informed consent was obtained from each participant's legal guardian. The researcher first called each guardian to inquire if they would be open to allowing their ward to participate in the study. The details of the study were explained on the phone and if the guardian wished to give consent, they were sent a document informing them, in detail, of the nature of the study. The guardians then emailed the signed consent form back to the researcher if they wished to participate. They were also informed that if their ward indicated that they did not wish to participate, they would be removed from the study without question.

Preference Assessment

A multiple-stimulus without replacement (MSWO) preference assessment was conducted with each participant to determine potential reinforcing stimuli. The MSWO was conducted in each participant's home. Tangible items such as blankets, stuffed animals, and sensory objects as well as food items were used during the preference assessment (Bowen, Shillingburg, & Carr, 2012). Edibles were utilized due to lack of responding to tangible items. MSWO implementation were based on procedures described by Carr, Nicolson, and Higbee (2000). Four potential reinforcing stimuli were selected by conducting staff interviews regarding each participant's preferences. Once stimuli had been selected, the researcher placed all items on a table or tray in

front of the participant. The researcher then instructed the participant to “pick one”. If the participant did not respond, the instruction was repeated up to five times, at which point the preference assessment would be conducted again after shift change. Once an item was selected, the participant had 10 s of access to the item, at which point the item was removed from the array. The remaining items were repositioned, and the process was repeated until all items had been picked. Attempts to pick multiple items were blocked. The MSWO was then implemented two more times later in the day when new staff were in the environment. Percentages were calculated by dividing the number of times each item it was chosen by the total number of trials each item was available. Percentages were then ranked from most preferred (1) to least preferred (5). Only the most preferred item were used during training.

Inter-observer Agreement (IOA)

IOA was obtained on 20% of all preference assessment, baseline, training, and generalization trials conducted. IOA was determined by dividing the number of agreements by the total number of trials conducted, and multiplying by 100 (Lundervold & Belwood, 2000). The secondary observer (O2) sat five feet away from the participant in a corner of the room being used for training facing the participant. The O2 was still able to observe the participant, but the participant was not able to interact with them.

Observer Training

The observer was recruited from support staff working with each individual. O2 was trained to accurately score manding responses during mand training trials using a confederate to role-play as a participant. Baseline O2 training trials with the confederate were conducted to assess accurate discrimination of mands. The confederate was taught a series of correct and

incorrect sign language motor movements. Instructions and picture prompts were given to the confederate to ensure treatment fidelity during O2 observer training. Training employed BST procedures (Loughrey et al., 2014; Nigro-Bruzzi & Sturmey, 2010) including an explanation of mand training, review of the mand training task analysis, modeling of motor movements, conducting a simulated trial, and practice in data recording. During O2 training both the researcher and O2 collected data on manding. Mastery criterion for observation was 90% correct across five consecutive trials. The performance of O2 were compared to that of the principal investigator and contingent feedback and praise provided. Errors were examined and feedback provided after review of the training script and photos. The same O2 was trained on the MSWO preference assessment identical to manding procedure training.

Baseline

Baseline was conducted in the same area of the home selected for training. During the baseline condition, a highly preferred item identified in the preference assessment was used during each trial. The researcher conducted three observations per week the during baseline condition. The item was presented to each participant at the beginning of the trial. The preferred item used was placed within eyesight of the participant, but out of arms' reach. If the participant emitted a mand for the item using any response topography, the response was scored as correct, though they will not receive the item. If the participant did not emit a response within 5 s of the presentation of the item, the response was scored as incorrect, and the experimenter conducted the next trial. The same preferred item was used for each training trial.

Mand Training

Prompted mands were recorded only during training (Finn, Miguel, & Ahearn, 2012). A correct response was scored if the participant emitted the sign language motor movement that corresponded to the target item within 5 s from the start of the trial and did not contain any other signs. An incorrect mand was scored if the participant did not emit the nonsense sign for the target item within 5 s from the start of the trial, or if the participant emitted the incorrect sign. During training trials, correct responses after prompting (not manual guidance) were considered correct.

The same preferred item was used during the intervention condition as during baseline. Twenty-minute training sessions were conducted three to five times per week. The most preferred item identified in the preference assessment was selected for instruction in manual sign language. The researcher stated, “this is _____” while pointing at the item and modeling the manual sign for that item. The researcher then provided a verbal prompt “now you do it”. If the participant independently emitted the target sign, the participant received praise and access to the item. If the participant did not emit a response within 5 s or made an incorrect response, the researcher stated “no, do this” while modeling the correct sign. If the participant did not emit the correct sign within 5 s, hand-over-hand guidance was implemented to form the manual sign, after which the participant received praise and access to the item. This continued until the participant independently emitted the correct sign language movement for the target item across five consecutive trials with 100% accuracy.

The researcher then placed the preferred item out of arms’ reach but directly in front of the participant, and then stated, “what do you want?” If the participant emitted the correct sign language movement within 5 s of the prompt, praise and access to the item occurred. If the

participant did not emit the correct sign within 5 s or the wrong motor movement was demonstrated, the researcher stated, “no, do this” while modeling the correct sign. If the participant did not emit the correct sign within 5 s, the experimenter stated, “do this”, and manually guided the participant’s hand into the correct position. The behavior was then reinforced with praise and access to the item. Training continued until the participant independently emitted the correct sign language movement across five consecutive trials at 100% accuracy. During training, any attempt to reach for the item without emitting the correct sign was blocked.

Generalization Probes and Maintenance Assessment

Baseline generalization assessment was conducted prior to mand training. Two baseline generalization probes were conducted per participant. The first baseline generalization probe occurred at session one, while the second occurred on the second to last baseline session. While in the natural environment a preferred item was placed within the participant’s field of vision, but out of arms’ reach. If the participant emitted the correct sign language motor movement within five-seconds of presentation, the participant was given access to the item. If the participant emitted an incorrect hand motor movement or did not respond, the item was removed, and a new trial began after 3-seconds (Fragale et al., 2012).

Post-training generalization probes were also conducted in each participant’s home after the acquisition criterion had been met. Generalization probes conducted following mand training occurred during the subsequent session after the criterion had been met. Staff members who worked with the participants every day and who have developed a positive rapport with them (e.g. little to no negative interactions between the participant and staff member) were trained to implement the manding procedure. Negative interactions were defined as few experiences where

staff raised their voice at the participant, or any other experience which may have been aversive that was not routine for the participant (medical appointments and other routine aversive situations related to health were not counted). Each trained staff member was instructed to refrain from giving the participant the preferred item unless the sign language motor movement taught during training was exhibited. Post-training generalization assessments were conducted in the same manner as those in baseline. Maintenance was assessed six weeks post-training.

Procedural Fidelity and Social Validity

A procedural task analysis (PTA) was used by a second observer who scored each step in the PTA as correct or incorrect on each instructional trial (Lechago et al., 2010). Procedural fidelity was assessed for 20% of total trials. Social validity was assessed utilizing the Abbreviated Acceptability Rating Profile (AARP), and was administered to six staff members (Tamowski & Simonian, 1992). Staff training on manding occurred during the second to last acquisition condition for all three participants. Five of the staff members trained were full-time staff and would see the participants every day Monday through Friday. One staff member was a relief staff who would see Mike 4-6 times per week

CHAPTER 4 RESULTS

Observer training, IOA, Preference Assessment, and Procedural Fidelity

The primary observer and O2 collected data on a confederate engaging in manding behavior as indicated on the confederate training script. O2 required six sessions to reach mastery, five consecutive responses at 100% accuracy, with a mean agreement of 83% obtained between the primary observer and O2. IOA was obtained on 20% of total trials with a mean agreement of 92%. Results of the MSWO indicated that Mike preferred Snickers bars, Ethan vanilla cookies, and Chad popcorn. IOA was obtained on 20% of MSWO trials ($M = 88\%$). Procedural fidelity was assessed on 20% of the total number of trials by a secondary observer. 100% agreement on manipulation of the independent variable was obtained.

Hypotheses

Hypothesis I: Acquisition of Mands Using Standard Mand Training

The results support Hypothesis I as indicated in Figure 1.3. During baseline, each participant's percentage of correct responding was at or near zero percent. Mike and Chad did not respond, whereas Ethan responded sporadically during baseline ($M=10\%$). All three participants demonstrated systematic and clinically significant increases in the percentage of correct manding responses following manipulation of the independent variable. Mike and Chad both required five trials to reach criterion, whereas Ethan required 11. The multiple probe design demonstrated experimental control and a functional relationship due to the behavior of interest changing following manipulation of the independent variable. This indicates that subject and setting confounds were ruled out such as maturation and coincidental events, as there was no change in the target behavior prior to independent variable manipulation. This change also

indicates that dependent and independent variable confounds such as observer drift, reactivity, and experimenter/observer bias were ruled out. Percentage correct for both Mike and Chad increased from 0% to 100%, and the percentage correct for Ethan increased from 0% to 90%. Results indicated a large increase in level immediately following the last baseline trial for all three participants. Mike and Chad reached the training criterion after five training trials, while Ethan reached criterion after 10 training trials. Data for all three participants was highly stable, with Mike and Chad at 100% correct across all training trials. Ethan's percentage correct was slightly lower and more variable ($R = 85-90\%$).

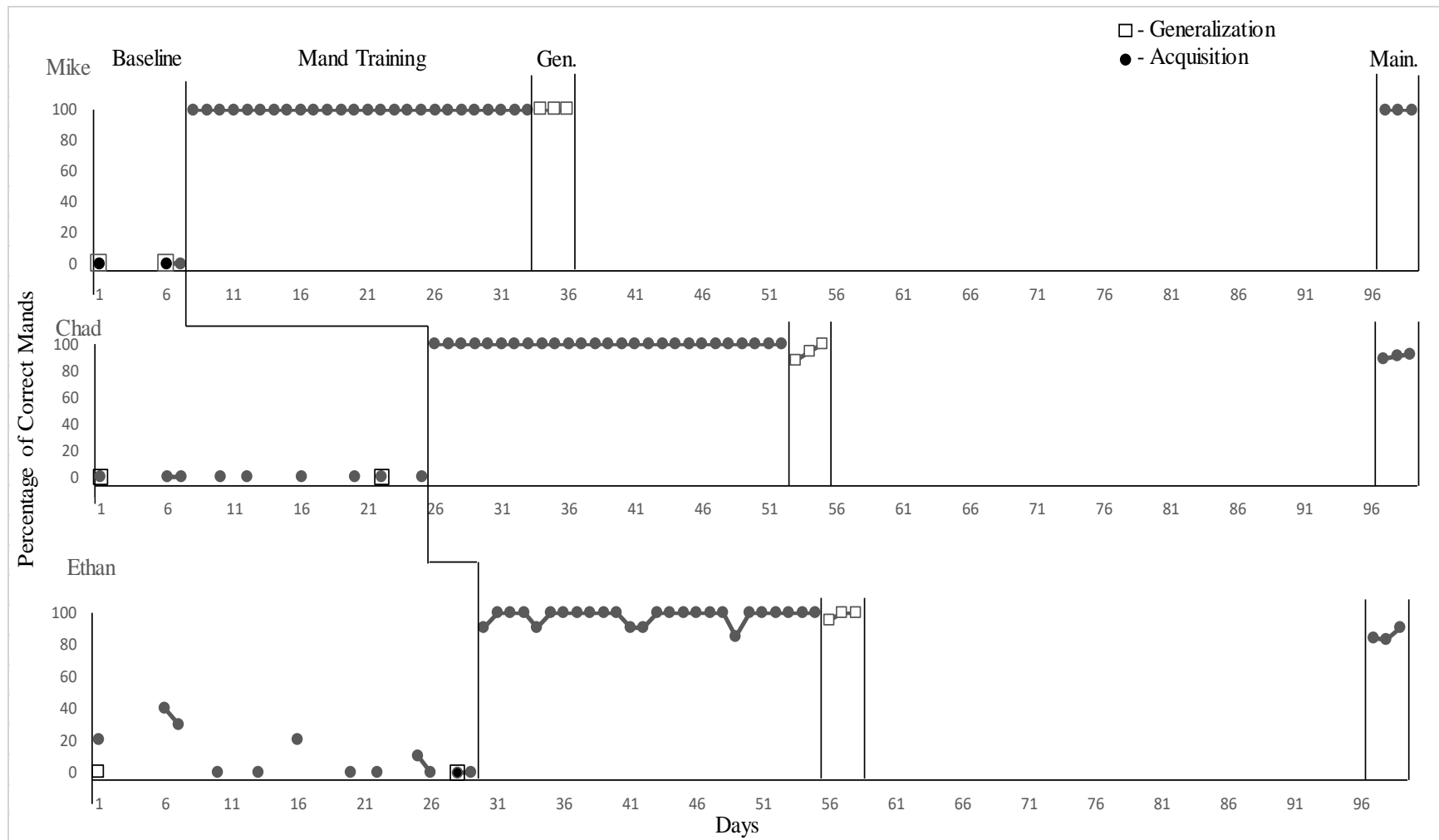


Figure 1.4: Acquisition, generalization, and maintenance of mand training for three adults with moderate to severe intellectual disability.

Hypothesis II: Generalization of Responding Across Trainers

During baseline generalization assessments, all participants demonstrated 0% correct responding. Due to a procedural error, additional acquisition training was conducted with Mike after he had met the acquisition criterion. Thus, generalization assessment was delayed. Generalization assessment occurred immediately after meeting the acquisition criterion for both Chad and Ethan. A significant degree of generalization of manding was observed with each participant. The first generalization trial was conducted by a novel assessor (N1); the second by O2; and the third by a second novel assessor (N2). Percentage correct for Chad was 100%, 88%, and 95%, respectively. Percentage correct for Ethan was 100%, 95%, and 100%. Overall, Mike demonstrated 100% correct across all three trials. Hypothesis II was supported.

Hypothesis III: Mand Training Outcomes will be Rated as Socially Valid Behavior Change

The Abbreviated Acceptability Rating Profile (AARP) was administered to six staff members that were trained to implement the mand training procedures (Tarnowski & Simonian, 1992). A mean AARP score of 39.9 (SD=1.06) was obtained indicating high acceptability. Results indicated that paraprofessionals working with the participants reported that the intervention was acceptable in relation to the target behavior each participant exhibited, and that the intervention was of benefit to the participants in acquiring communicative behaviors. Results also indicated that behavior change was rated as socially valid. As such, Hypothesis III was supported.

Hypothesis IV: Maintenance of Manding Skills will be Maintained

Maintenance assessment occurred six weeks after the last generalization trial. Results were maintained for each participant and ranged from 83-100%. Mike demonstrated 100%

correct responding; Chad's performance ranged between 89-92%, while Ethan's performance ranged between 83- 90% correct. Hypothesis IV was confirmed.

CHAPTER 5 DISCUSSION

The primary purpose of this study was to systematically replicate the effect of standard mand training with adults with ID. A clinically significant change in the repertoire of the participants was observed following standard mand training. In contrast to children with ASD, the rapidity with which the participants in this study acquired the manding response resulted in fewer trials required to reach criterion and more powerful generalization and maintenance assessments. The current study systematically replicated the effectiveness of standard mand training with adults with ID and extended the literature on the use of mand training procedures through evaluating its utility with neglected populations (Bourret et al., 2004; Bowen et al., 2012; Hall & Sundberg, 1987).

Two novel trainers (O3, O4) conducted generalization probes on two sessions, while O2 conducted the third generalization probe, with each participant. Generalization is an important aspect of any psychological intervention. The results of this study lend further support regarding the emphasis of generalization and its overall importance in behavioral research (Albert et al., 2012; Carbone et al., 2010; Lee, Luke, & LeePark, 2014; Nigro-Bruzzi & Sturmey, 2010). Secondary observers (O2-O4) were taught the manding procedure prior to the generalization assessment. Secondary observers rapidly met the acquisition mastery criterion and maintained the same level of fidelity during the generalization assessment. Rapid acquisition and maintenance of high-level performance supports the proposition that SMT is the easiest manding procedure to teach paraprofessionals, though more research is needed in this area.

While generalized manding was observed with two novel assessors and O2, situational variables may have controlled responding as the assessment occurred where mand training was

conducted. As a result, broad-based conclusions as to the occurrence of generalized manding behavior outside of the training situation, e.g. other rooms of living quarters, etc. is not available. Generalization trials were not conducted in situ due to the conditions being not supportive of systematic assessment in novel environments. Since O2 served as an observer during manding training trials, it is possible that O2 could have acquired discriminative and conditioned reinforcer properties and was thus not a true novel assessor. Of the studies examined, none reported the characteristics of assessors taking part in generalization assessments. Due to the context, selection of truly novel assessors was not feasible. The same issue was present with maintenance assessment. Additional research should be conducted in which each generalization trial is conducted with novel assessors. Research should also examine generalization of manding to novel situations where such behavior is likely to be functional.

Maintenance needs to be assessed for any behavioral intervention to ensure that the change in behavior remains in the absence of training. If the behavior is not maintained it is an indication that the behavior is not functional in that environment or intermittent reinforcement for the target behavior was not established (Cooper et al., 2007). The current study assessed maintenance six weeks following the generalization condition. However, this length of time may not have been sufficient. Few studies reviewed specifically mentioned maintenance data as it relates to behavior change but despite this limitation, the current study lends added support to the importance of maintenance assessment in behavioral research (Carter and Grunsell, 2001; Hunt and Goetz, 1988; Nigro-Bruzzi et al., 2010). Ideally, a lengthier period should have been used, however this was not possible given the available resources. Future research should utilize a lengthier period of time before assessing maintenance of behavior change.

Anecdotally, the staff completing the AARP reported that they had observed improved functioning of the participants during and after the intervention was implemented. They also reported that the intervention was easy to use, and that they would implement the mand training in the future when given the chance. All but one staff indicated that they would feel very confident in their ability to implement the intervention with minimal supervision. Three studies examined social validity in the context of staff or parent training (Houghton, Bronicki, & Guess, 1987; Ingvarsson, 2011; Loughrey et al., 2014). Current results extend the research on social validity ratings for mand training procedures by assessing the acceptability and benefit using 24-hour direct care staff. Results of the social validity assessment are in line with other studies as they relate to children with ASD (Albert et al., 2012; Bowen, Shillingsburg, & Carr, 2012; Drasgow et al., 2016; Sigafoos & Littlewood, 1999).

The participant whom was lost to attrition affected the length of the baseline condition of the other participants. Acquisition data indicated a slow learning curve due to weak stimulus control exerted by the prompting procedure. Consequently, baseline conditions were overly long for Chad and Ethan as the investigator attempted to gain experimental control over the behavior of interest. Upon deeper investigation of her medical records, it was discovered that participant 4 was hearing impaired. Unfortunately, no information regarding hearing impairment was available in her immediate medical record. More comprehensive screening methods are needed to identify appropriate candidates for mand training, especially when they reside in state funded facilities. Research with persons with ID and hearing impairment would yield valuable insight into procedures and interventions that may improve treatment outcomes for these individuals (Romer & Schoenberg, 1991b).

While the purpose of the current study was to systematically replicate standard mand training with adults with ID, there is no clear definition of what constitutes “standard” mand training. In the context of the current study, standard mand training was defined as mand training that manipulates a motivating operation while teaching a communicative response and correcting errors. As such, standard mand training does not include replacement of challenging behaviors, as it is utilized to teach a communicative response, not replace a maladaptive behavior. Two general categories of standard mand training (SMT) have been employed: (a) basic mand training (Figure 1.1) and (b) elaborated mand training. (Figure 1.2). Of these two categories, basic mand training is easier to use in a clinical/applied setting, has fewer procedural elements, fewer necessary skills on the part of the trainer/implementer, and is used to establish a communicative repertoire rather than replace maladaptive behavior, or use chain interruption procedures. Elaborated mand training, while more difficult to implement in clinical/applied settings (i.e. utilizes aspects that require more knowledge, training and skill), also uses error correction. For these reasons, both SMT procedures were selected to establish a verbal repertoire among adults with ID.

Systematic replication is an important aspect of scientific research, as replication of results increases the generality of findings within and between populations, settings, and target behaviors. However, researchers do not routinely attempt to replicate studies conducted by other investigators. If a researcher cannot replicate research findings, this indicates that there may be additional extraneous variables affecting the results. Researchers may attempt to alter some aspect of the experiment such as the independent variable, materials used, or general procedures in order to achieve the same result. In other situations, a failure to replicate may indicate that the treatment or methodology is flawed, and therefore either should not be used, or should be altered

even further. Additional research is needed regarding adults with ID and their ability to acquire and maintain a manding repertoire. Given the success of the SMT procedures employed, the replication of these findings is needed.

Results of the current study address a gap that exists in behavioral research on mand training with populations other than children with ASD. The findings support the use of standard mand training with adults with ID. In this regard, standard mand training procedures can be easily taught to paraprofessionals who can then implement the procedures with adults with ID. Because standard mand training was shown to be easily learned by paraprofessionals and the mands quickly acquired by middle aged, minimally verbal adults with ID, standard mand training protocols can be easily be developed and disseminated to service providers. Standard mand training is a valuable and effective procedure for this neglected population. Through implementation of an efficient and effective procedure for communication, the aberrant behavior of individuals with ID residing in state run facilities will result in a better standard of care and quality of life. More research is needed to determine if standard mand training can truly be utilized in these situations.

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APPENDIX A

TASK ANALYSIS FOR SECONDARY OBSERVER TRAINING AND FIDELITY CHECK
FOR MAND TRAINING

WITH CORRECTION PROCEDURE

Instructions:

<u>S^D</u>	<u>Response</u>	<u>Score</u>
1. Item placed in front of participant	S makes correct manual sign for the item. ¹	+ - NA
2. S pointed to item	S makes manual sign within 5 seconds of S ^D .	+ - NA
Prompt: "Do this _____" while making manual sign for item.		
"Now you do it"		
(If incorrect response or to Step 4)		
3. Correct sign for object observed	Descriptive Praise and give the object to the S.	+ - NA
4. Incorrect response	"No, do this" while demonstrating the correct sign.	+ - NA
5. Wait 5-seconds	Incorrect response.	+ - NA
6. Incorrect response	"Do, this" + partial physical guidance to make the correct sign.	+ - NA
5. Wait 5-seconds	"Do this" + full physical guidance to make the sign.	+ - NA
6. Manual sign performed	Give descriptive praise and present object.	+ - NA

¹ If correct response at step 1 or any subsequent prompted step, go to Step 6. If an incorrect response occurs at Step 1 proceed through the task analysis and correction procedures until Step 6 is completed.

APPENDIX B

CONFEDERATE AND OBSERVER 2 MAND TRAINING PROTOCOL

Instructions to the confederate: At the beginning of each trial, you will be asked “What do you want?” You are to respond based on the photos or written response below.

Trial 1:



Trial 2:



Trial 3:



Trial 4:

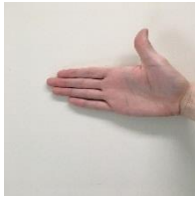


Trial 5:

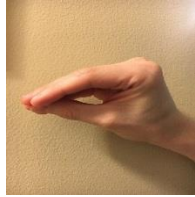


Trial 6: Don't Respond

Trial 7:



Trial 8:



Trial 9:



Trial 10: Don't Respond

Trial 11:



Trial 12:



Trial 13:



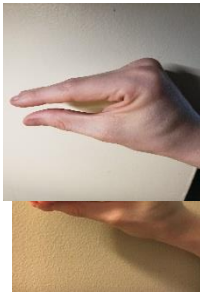
Trial 14:



Trial 15:



Trial 16:



Trial 17:



Trial 18:

Don't Respond

Trial 19:



Trial 20:

Don't Respond

Trial 21:



Trial 22:

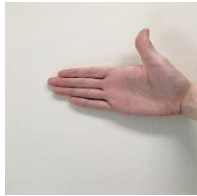


Trial 23:



Trial 24:

Trial 25:



Trial 26: Don't Respond

Trial 27:



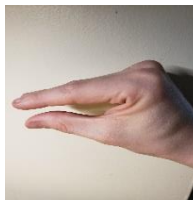
Trial 28:



Trial 29:



Trial 30:



APPENDIX C

ABBREVIATED ACCEPTABILITY RATING PROFILE

(Tamowski & Simonian, 1992)

Complete the items below by circling the word below each question that best indicates how you feel about the treatment.

1. This is an acceptable treatment for the participant's behavior.

Strongly	Disagree	Slightly	Slightly	Agree	Strongly
Disagree		Disagree	Agree		Agree
2. The treatment should be effective in changing the participant's behavior.

Strongly	Disagree	Slightly	Slightly	Agree	Strongly
Disagree		Disagree	Agree		Agree
3. The participant's behavior is severe enough to justify the use of this treatment.

Strongly	Disagree	Slightly	Slightly	Agree	Strongly
Disagree		Disagree	Agree		Agree
4. I would be willing to use this treatment with my family member.

Strongly	Disagree	Slightly	Slightly	Agree	Strongly
Disagree		Disagree	Agree		Agree
5. This treatment would not have bad side effects for the participant.

Strongly	Disagree	Slightly	Slightly	Agree	Strongly
Disagree		Disagree	Agree		Agree
6. I liked this treatment.

Strongly	Disagree	Slightly	Slightly	Agree	Strongly
Disagree		Disagree	Agree		Agree
7. The treatment was a good way to handle the participant's problem.

Strongly	Disagree	Slightly	Slightly	Agree	Strongly
Disagree		Disagree	Agree		Agree
8. Overall, the treatment would help the participant.

Strongly	Disagree	Slightly	Slightly	Agree	Strongly
Disagree		Disagree	Agree		Agree

APPENDIX D

HUMAN SUBJECTS APPROVAL

Dear Jarrod Vaughan:

Your request to amend your research project, 'A Systematic Replication of Standard Mand Training with Adults with Intellectual Disabilities', was approved by the University of Central Missouri Human Subjects Review Committee on 3/28/2018. You may collect data for this project until **3/28/2019**. Your informed consent is also approved until **3/28/2019**.

If an adverse event (such as harm to a research participant) occurs during your project, you must IMMEDIATELY stop the research unless stopping the research would cause more harm to the participant. If an adverse event occurs during your project, notify the committee IMMEDIATELY at researchreview@ucmo.edu.

The following will help to guide you. Please refer to this letter often during your project.

- If you wish to make changes to your study, submit an “Amendment” through Blackboard under the “Amendment and Renewals” tab. **You may not implement changes to your study without prior approval of the UCM Human Subjects Review Committee.**
- If the nature or status of the risks of participating in this research project change, submit an “Amendment” through Blackboard under the “Amendment and Renewals” tab. **You may not implement changes to your study without prior approval of the UCM Human Subjects Review Committee.**
- If you are nearing the expiration date for collecting data for this project (3/28/2019) and you have not finished collecting data:
 1. submit your project application via Blackboard under the “Amendment and Renewals” tab (include any revisions and/or amendments approved since you submitted your application initially)

AND

 2. submit a “Renewal Report” through Blackboard under the “Final/Renewal Report” tab.
- **When you have completed your collection of data, please submit the “Final Report” found on Blackboard under the “Final/Renewal Report” tab.**

If you have any questions, please feel free to contact me at researchreview@ucmo.edu.

Sincerely,



Kathy Schnakenberg
Program Administrator/Research Compliance Officer

Office of Sponsored Programs and Research Integrity
University of Central Missouri