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Dedication

To my husband who has supported me through this entire journey and to my family and friends.

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Abstract

This study reviews the current research on applied behavior analysis (ABA) and equine-assisted activity and therapy (EAAT) for individuals with autism spectrum disorder (ASD) on verbal communication behavior. Research on ABA interventions for verbal behaviors has shown substantial increases in verbal operant(s) such as manding with children with ASD. EAAT intervention studies regarding communication to include manding behavior have also shown promising increases with children with ASD. This study used a multiple baseline design across participants to establish whether there is a functional relation between mand training integrated in a specific type of EAAT (Equine-Assisted Learning or EAL) activity and manding behaviors in individuals with ASD.

Keywords: mand training, interrupted chain procedure, applied behavior analysis, ABA, autism spectrum disorder, ASD, behavior, combining, equine-assisted therapy, EAAT, EAL manding, verbal, communication, single case, multiple baseline design

Chapter 1

Introduction

Statement of the Problem

Researchers continue to strive to provide access to the best possible therapy options or treatment plans for students with autism spectrum disorder (ASD) that have verbal communication difficulties, particularly requesting (manding) behavior. This verbal behavior is also referred to as a mand. B. F. Skinner (1957) first coined the term verbal operant in chapter three of *Verbal Behavior*. Skinner operationally defined a mand as a form of verbal behavior that is controlled by deprivation, satiation—now called motivating operations (MO)—as well as a controlling history (Skinner, 1957). Teaching students verbal communication skills has high social validity because the skill enables the student to have a more effective interaction with their current environment and exposes them to new environments, like new reinforcers, and should take precedence over other skills they might use in the future (Cooper et al., 2007).

Presently, there are a variety of popular socially accepted therapy options being utilized to improve communication and verbal skills for students with ASD (i.e., speech therapy, applied behavior analysis, equine assisted therapy). For the purposes of this research study only two of these therapy options are focused on and discussed. The first one is an evidenced based practice called Applied Behavioral Analysis (ABA) therapy and the other is an alternative experimental therapy referred to as Equine Assisted Activity and Therapy (EAAT). EAAT is an umbrella term that encompasses any therapy that involves a horse during the therapy session (Cooper et al., 2007; Dewkett et al., 2016; Fine, 2015). To date, however, there is little research conducted on the effects a child with ASD receiving an intervention package that integrates ABA and an

EAAT therapy. Currently, there is little research on different interventions from these different fields of study being integrated together as one intervention.

Evidence-Based

Cooper et al. (2007) defines an evidence-based practice as “a treatment or intervention method that has been demonstrated to be effective through substantial, high-quality scientific research” (p. 74). ABA is a scientific approach to understanding environmental factors that affect behaviors that are socially significant and the development of technologies that use the discovery of this approach to change behaviors (Cooper et al., 2007; Gambrill, 2013). Today, after years of demonstrable results through scientific research, ABA has been accepted as an evidence-based practice therapy treatment (Behavior Analyst Certification Board [BACB], 2020; Cooper et al., 2007; Larsson, 2013). This progression has led to behavioral clinics (i.e., Behavioral Innovations or CLASS) becoming more prominent and they continue to pop up all over the country as more states implement laws that allow ABA services provided by Board Certified Behavior Analysts (BCBA) to be covered by medical insurance (Deochand, & Fuqua, 2016; LeBlanc et al., 2012).

Mand training is just one component of verbal behavior training, which is a technology that has been developed from ABA (Albert et al., 2012). Numerous studies have examined the effectiveness of procedures for teaching students ages 2 to 18 with ASD manding verbal behavior skills (Albert et al., 2012; Carnett et al., 2017). From these studies’ results, there have been several evidenced-based instructional practices identified for teaching manding verbal behavior to children with ASD (Albert et al., 2012; Carnett et al., 2017; Lechago et al., 2010). One such recognized instructional practice is the behavior chain interruption procedure, which is when an item is removed that is needed to complete a behavioral chain (Albert et al., 2012; Lechago et al., 2010). Carnett et al. (2017) did a systematic review of 28 studies that used

behavior chain interruption procedures during mand training and reported every study had positive results with respect to acquisition of the targeted mand behavior. Since ABA therapy and the mand training with interruption chain procedure are both considered evidence-based practices, the next course to further the research is to investigate their effectiveness when integrated into other popular alternative therapy options that have been successfully used to improve verbal behavior skills (Carnett et al., 2017).

Alternative Therapies

The increasing need for therapy services for children with ASD has also caused an increase in the demand for alternative interventions such as Animal-Assisted Therapy (AAT). Alternative therapy or intervention is a term often used to describe therapy and interventions that lack the evidence to be considered evidence-based due to the limited number and lack of rigor in available research studies (Fine, 2015). The Interactive Autism Network (IAN) in 2011 conducted a preliminary study on AATs being utilized by students with autism and found that about 6% of the 8,000 families that had participated in the survey reported using some form of AAT. Of those who mentioned use of AAT, 68% utilized some form of EAAT. In addition, 83% of those families using some form of AAT reported their student had improved communication skills after using the therapy (IAN, 2011).

Horses have been used for their therapeutic value for centuries all over the world and there is a strong belief among those who practice within the EAAT field that horses can mirror an individual's true emotions, even if they try to conceal them (Boyd, 2013; Fine, 2015). Horses have this amazing capability versus a dog or cat, because they are prey animals, and this makes them hypersensitive to their surroundings and attuned to nature. Furthermore, it has been documented that horses provide immediate emotional behavior feedback without judgement in a

metaphorical manner that expresses an unfiltered truth of the human client's emotional state and behavior (Boyd, 2013; Fine, 2015).

When this capability and sensitivity is combined in a therapeutic learning environment for children with ASD, then the special benefits of EAAT become clear. One such qualitative study validates some of these benefits from EAAT for children with ASD, stating students were observed to have an “increase in self-confidence/self-worth; emotional regulation; decreased depression, anxiety, and suicidal ideation, improved anger/self-management, the development of positive coping skills and strategies; improved interpersonal relationship skills, and improved academic performance” (Boyd, 2013, p 39).

The only form of EAAT that has risen above the “alternative treatment status” is the well-known Hippotherapy (HPOT), which is essentially the combination of physical therapy (PT) and therapeutic riding (TR), a specific type of EAAT (American Hippotherapy Association [AHA], 2016; Fine, 2015). Like ABA and EAAT therapies today, PT and TR operated as two separate therapy options until the 1970's when physical therapists in the United States began to develop treatment uses for the movement of the horse (AHA, 2016; Fine, 2015). This led to further standardized curriculum development and eventually, in 1999, The American Hippotherapy Certification Board was established and the first Hippotherapy Clinical Specialist (HPCS) examination became a requirement for licensure (AHA, 2016; Fine, 2015).

Despite HPOT's recognition as a more developed and standardized treatment option, other EAAT therapies (i.e., equine-assisted learning [EAL] or equine-assisted psychotherapy [EAP], have not been so fortunate; to this day, they are still considered a more alternative or experimental therapy approach due to the lack of rigorous research (Dewkett et al., 2016; Fine, 2015). To illustrate, one meta-analysis research study on the AAT intervention's effectiveness

for reducing depressive symptoms concluded that only 5 of the 165 studies found from a search of 18 databases using 21 search terms met the minimal criteria for a quality research design (Stouter & Miller, 2007). Another meta-analytic study done on AAT as an intervention stressed that only 3% of the sample studies taken met the standards for scientific validity (Marino & Lilienfield, 2007). With hippotherapy as an example of the results that can come forth through rigorous research studies on integrating two therapy options successfully together, this supports the conclusion that new research is needed to examine the effectiveness of integrating ABA and a specific type of EAAT like EAL (Cooper et al., 2007; Fine, 2015). Studying the integration of the two therapies as one intervention is the first step to understanding its impact to the field.

The Gap in Research

Through an extensive search I found many studies using ABA treatments (Albert et al., 2012; Carnett et al., 2017; Cooper et al., 2007; Lechago et al., 2010) and many studies using varieties of EAAT interventions (Beck & Katcher, 2003; Fine, 2015; Wilson, 1984) in the past decade that demonstrated effectiveness of improving targeted communication behaviors for individuals with ASD, however, no studies were found that integrated both therapies together as one intervention. Due to the large volume of studies found in the literature, only the most relevant studies (within the last 12 years) were listed in a table format (see Appendix G). There is a social importance for the better wellbeing of those individuals with ASD to find the best possible treatment programs or plans available. This study is significant in that it examines the impact of the integration of these two well-known treatment options.

Significance

Prevalence

The national trend, according to the National Center for Education Statistics (NCES; 2019), indicates the number of students (ages 3-21) who received special education services

under the Individuals with Disabilities Education Act (IDEA) between 2011-2012 and 2017-18 increased from 6.4 million to 7.0 million and total public school enrollment increased from 13% to 14% (National Center for Education Statistics, 2019.). Enrollment percentages for students with autism also increased during this same time frame from 0.9% to 1.4% (National Center for Education Statistics, 2019). This has increased the demand for best practices in teaching children with ASD to include ABA therapy as well as alternative interventions, such as EAAT (Fine, 2015; Westling et al., 2015).

Deficiencies in the Evidence

The increased demand for evidence-based practices has led to concerns regarding which intervention program packages are the most efficient in accomplishing results for children with ASD. Can it be said for interventions and therapy programs designed to help individuals with ASD “the more the merrier”; are we doing what’s best for the individual with disabilities by loading them up on therapy programs? Does integrating these two interventions make them more effective, like the hippotherapy example? Are there possible side effects similar to what we find with prescription drugs? Research literature on both these interventions have reported effectiveness as an intervention for children with ASD, however no study could be found that explored the impact of integrating ABA and a specific type of EAAT intervention specifically together as one intervention. This study is just the first step to establishing a possible functional relationship that could lead, eventually, to whole new form of evidence-based therapy.

Impact on the Quality of Life

The purpose of this study is to measure the impact on verbal manding behavior on children with ASD with low verbal manding levels that receive an integrated treatment of mand training with EAL, a specific type of EAAT that utilizes horses during the learning “treatment”

session but without a licensed therapist. The specifics as to why this type of EAAT was chosen to be integrated with the mand training intervention is discussed in detail in Chapter Two. The aspiration of this single-case study is to employ a multiple baseline design across participants with ASD who have low requesting verbal behavior at a medical treatment center to see if there is a functional relationship between an intervention that integrates ABA and EAL therapies and the impact on verbal manding behavior. The data from this study is crucial for developing appropriate and effective therapeutic interventions aimed at treating and assisting children with ASD with their verbal and communication skills that promote behavioral and social growth.

Chapter 2

Literature Review

Definition of Autism Spectrum Disorder (ASD)

The word “autism” is a Greek word meaning “auto” or “self”, which describes the behavioral predisposition of individuals with autism to be seemingly in their own world (National Institute of Mental Health, 2018). The National Institute of Mental Health (NIMH) and the American Psychiatric Association (APA) define Autism Spectrum Disorder (ASD) as a group of developmental conditions that significantly impacts an individual consistently in three core domains: social, behavior, and communication (APA, 2018; NIMH, 2018). In the social domain, some general characteristics that are representative of conditions that affect a person with ASD include impaired social interactions (e.g., failing to respond to their name, avoiding eye contact with other people, only interacting with others to achieve a specific goal) (Tan & Simmonds, 2018; Westling et al., 2015). Another core domain that is affected for those with ASD is communication, generally displayed with atypical communication abilities (e.g., not able to denote their preferences, uneven language development, repetitive or rigid language) (Tan & Simmonds, 2018; Westling et al., 2015). For those with ASD their behavior may also include stereotypical repetitive behaviors (e.g., lining up toys, hand flapping, dropping items repeatedly) (Tan & Simmonds, 2018; Westling et al., 2015). According to the Center for Disease Control and Prevention (CDC; 2019), the prevalence of ASD has become second to intellectual disabilities amongst all developmental and mental disabilities.

Prevalence and Increase

The CDC started tracking ASD in 1998, along with other developmental and intellectual disabilities (CDC, 2019; NIMH, 2018). Data from the 39th Annual Report to Congress on the

implementation of the Individuals with Disabilities Education Act (IDEA, 2004) corroborate these findings; students served under the category of ASD in education have steadily increased as the fourth most common disability category behind Specific Learning Disabilities (SLD), Communication Disorders, and Other Health Impairment (U.S. Department of Education, 2017). From the 1960s through the 1980s, ASD was thought to be rare with a prevalence of just 4 to 5 per 10,000 individuals (Miller et al., 2013; Newshaffer et al., 2007). By the beginning of the 21st century, the CDC estimated that in the United States the prevalence of ASD was in the range of 1 in 150 individuals, more than a 15-fold increase almost a half a century later (CDC, 2019). More recently, in 2014, the CDC statistical rate of individuals diagnosed with ASD was reported to be 1 in 54 with it being four times more common in boys than girls in their Morbidity and Mortality Weekly Report (MMWR) (Baio et al., 2018; CDC, 2019). Furthermore, the CDC reported individuals with ASD are more likely to also have intellectual disabilities than with other developmental and mental disabilities (CDC, 2019). Subsequently, they also identified those with ASD, and intellectual disabilities tended to have lower communication levels compared to the general public about their wants and needs and taking care of themselves (CDC, 2019). It is important to take into consideration that the definition and criteria for an ASD diagnosis has changed over time and may have become more applicable to a larger number of individuals (Miller et al., 2013; Newshaffer et al., 2007).

Prevalence of Deficits in “Verbal Communication”

One of the primary diagnostic criteria for ASD includes deficits in language and verbal communication functioning (Mody & Belliveau, 2013). Language is a human behavior that is receptive in nature and consists of either a verbal, gestural, or written communication form (Sundberg & Michael, 2001). Language abilities in individuals with ASD can vary from

nonverbal to high individualistic language to include but not limited to echolalia and abnormal prosody (Mody & Belliveau, 2013). Originally, the National Research Council (2001) reported that over half of individuals diagnosed with ASD failed to acquire verbal communication skills; however, in a more recent study by Tager-Flusberg and Kasari (2013) it was reported to be closer to 30%.

Identification

DSM-V. The Diagnostic and Statistical Manual of Mental Disorders (DSM-V) was developed by the American Psychiatric Association (APA) as a diagnostic tool to standardize criteria and has aided clinicians in their process to identify individuals with ASD (APA, 2013; CDC, 2019). Initially, autism had its own diagnostic category separate from other categories, such as Disintegrative Disorder, Rett syndrome, and Asperger syndrome; however, the APA (2018) and the CDC (2019) are now in favor of using just one umbrella term of Autistic Spectrum Disorder (ASD).

The CDC (2019) and the APA (2018) described screening for ASD as a two-step process: (a) a developmental screening conducted by a qualified specialist and (b) a comprehensive diagnostic evaluation administered by a qualified specialist. Currently, there are no blood tests or medical procedures that can diagnose or cure ASD (APA, 2018; CDC, 2019).

Possible early indicators of ASD in children include loss of language or not developing verbal skills, such as not babbling, pointing, or making meaningful gestures by the one-year mark. Some additional indicators include if not a single word has been spoken by the 16th month mark or are unable to combine two words by the average age of two (National Research Council, 2001; Westling et al., 2015). The CDC affirmed children are usually diagnosed after the age of four, even though ASD can be diagnosed as early as the age of two (CDC, 2019).

Common Characteristics

Socialization. Individuals with ASD often have deficiencies in social behavior. For example, individuals identified with ASD tend to have difficulties responding to social cues such as facial expressions and eye contact (APA, 2018; CDC, 2019). This characteristic further causes issues for individuals with ASD in developing, understanding, and maintaining relationships with other individuals (APA, 2018; CDC, 2019). Other potential social abnormalities of individuals with ASD can take the form of inappropriate clinging, antisocial behavior, lack of empathy, and chronic anxiety behavior to normal daily events (Miller et al., 2013).

Behavior. Besides the substantial impairment in social skills, many students with ASD constantly struggle with sensory integration and motor functions that interfere with their ability to be fully included in the general education classroom and community setting (Smith, 2004; Tan & Simmonds, 2018; Wuang et al., 2010). In fact, a study by Kanne et al. (2011) looked at over 1,000 individuals with “high functioning” ASD and reported there were deficits in adaptive behavior areas, specifically in socialization, daily living skills, and communication. In addition, children with ASD usually have difficulty applying concepts and generalizing these skills to other environments or situations and may have an increase in the severity of their behavioral frustrations, usually displayed in more challenging behaviors such as tantrums, screaming, crying, aggressions, and other self-injurious behaviors (National Research Council, 2001; Westling et al., 2015). The most common behavioral observations for individuals with ASD reported by the CDC (2019) and the APA (2018) were restricted and repetitive behaviors including, but not limited to, obsessions with lining up/stacking toys or repeatedly turning lights on/off or opening/shutting doors.

Verbal Communication. Some general verbal communication deficits reported to be associated with ASD are abnormalities in speech, such as echoing what they hear or what is said to them, difficulties in normal exchanges in conversations, speaking in odd patterns or pitches, and “scripting” from favorite shows (APA, 2018; CDC, 2019; Miller et al., 2013). In addition, Newshaffer et al. (2007) and Rogers (2004) both described regression ranges from 25% to 50% of children with ASD who actually lose acquired language and social skills before the age of two. These cognitive issues act like a negative domino effect for individuals with ASD because these differences then lead to problems with verbal communication behavior, which then ultimately impacts their long-term ability to acquire social skills (Tan & Simmonds, 2018; Westling et al., 2015).

Manding Deficits. Manding refers to the requesting verbal communication behavior used to ask for a desired item or activity and, while manding is just one aspect of verbal behavior, it is usually the first one to be taught because of its impact on a child’s ability to access their environment (Cooper et al., 2007). The core issue with verbal communication in individuals with ASD is the limited display of manding behavior to express their needs and wants using typical language (APA, 2018; CDC, 2019). It is also important to note during the preverbal phase a key risk factor used to identify ASD in a child is the lack of behaviors such as symbolic gestures (e.g., showing or pointing out objects of interest), which then cascades into missed learning opportunities for building vocabulary and manding verbal behavior repertoire (Mody & Belliveau, 2013). Furthermore, deficits in verbal communication skills have a direct relation to social skills and emotional regulation, which in turn, can result in lower social acceptance in employment and community environments, increased social isolation, and higher levels of anxiety and depression (Tan & Simmonds, 2018; Westling et al., 2015).

Applied Behavior Analysis (ABA)

Applied behavior analysis (ABA) is a science in which strategies are derived from the principles of behavior. They are then systematically applied as an intervention to improve socially significant outcomes by identifying the function of behaviors (Cooper et al., 2007). According to Baer, Wolf, and Risley (1968), ABA is the “process of applying sometimes tentative principles of behavior to the improvement of specific behaviors, and simultaneously evaluating whether any changes noted are indeed attributable to the process of application and if so, to what parts of that process” (p. 91). Another important component of ABA is its emphasis on context (environment) influences and building on client’s and significant others’ behavior repertoires that they already possess (Cooper et al., 2007; Gambrill, 2013). For example, with ABA, a therapist will try to identify the variables that trigger behaviors of concern, which is usually achieved through conducting a descriptive analysis and then conducting a functional analysis to see if the theory of the function of the behavior is correct (Cooper et al., 2007; Gambrill, 2013). From there, the best intervention is selected and then implemented, and data is continually collected to determine if the targeted behavior improves. If it does not, then another function analysis is conducted to see what variables that may influence the behavior were missed (Cooper et al., 2007; Gambrill, 2013). This process is repeated as many times as necessary until the targeted behavior is improved upon (Cooper et al., 2007; Gambrill, 2013). ABA has extensive research promoting its effectiveness across a variety of populations (i.e., ASD, intellectual disabilities, and communication disorders) and disciplines (i.e., communication and social skills) (Cooper et al., 2007).

Brief Overview of ABA

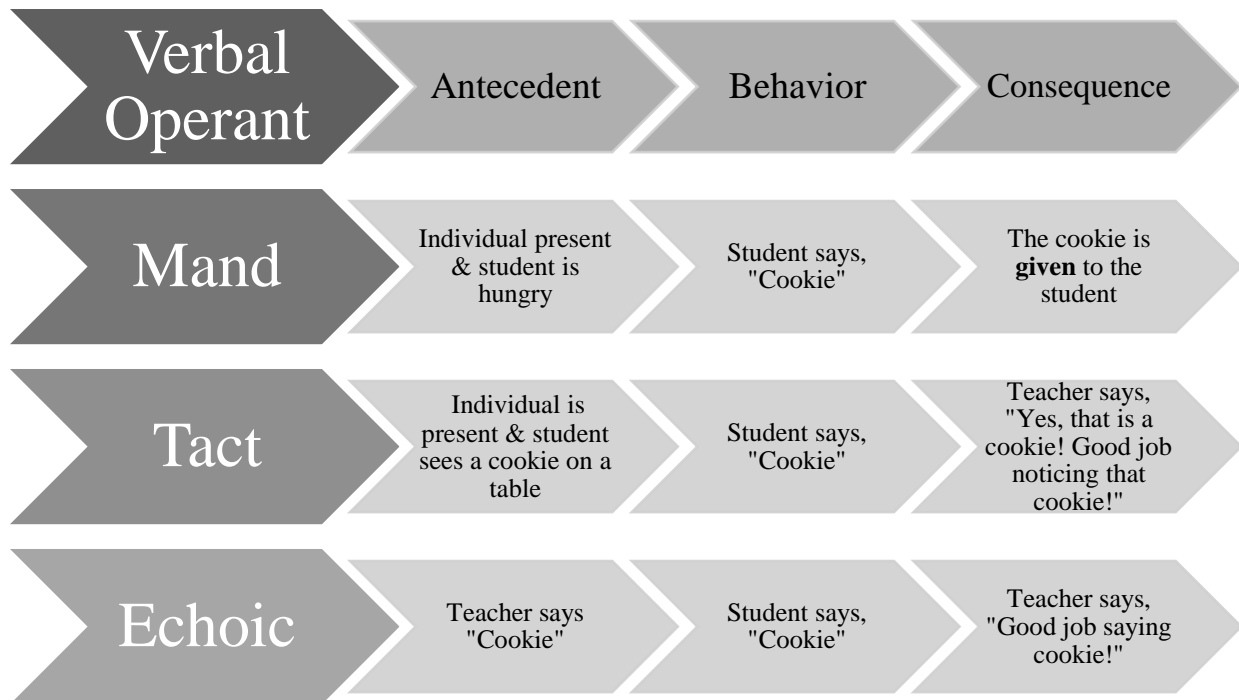
Cooper et al. (2007) briefly explained the history and development of ABA, which consists of three major foundations: behaviorism, experimental analysis of behavior (EAB), and ABA. The development of this branch of science originally began with behaviorism, the theory that all behaviors are caused by an external stimulus (Cooper et al., 2007). Then, starting with Watson's new theory (1913), the field of psychology started to go a whole new direction (Catania, 2017; Cooper et al., 2007). Skinner, with his research and publication of *The Behavior of Organisms* (1938), founded experimental analysis of behavior (EAB), which investigates relations between the function of a behavior and environmental variables (Catania, 2017; Cooper et al., 2007). While, applied behavior analysis (ABA) became the science of developing interventions to improve behaviors (Catania, 2017; Cooper et al., 2007). The first study to be published and considered an ABA study, due to their use of principles of operant conditioning on human recipients, was by Fuller in 1949 (Catania, 2017; Cooper et al., 2007). Skinner then did further research on the behavioral analysis of language and it took him 23 years to publish his findings (Cooper et al., 2007; Skinner, 1957).

Requesting/Manding Verbal Behavior. Skinner, in 1957, first coined the phrase manding or mands in *Verbal Behavior* to describe or categorize the requesting behavior he observed in his research. He stated, "the term 'mand' has certain mnemonic value derived from 'command,' 'demand,' 'countermand,' and so on, and is conveniently brief" (Skinner, 1957, p. 35). He further defined verbal behavior as behavior that is reinforced through another person's response, making verbal behavior a key component to social behavior and skills (Cooper et al., 2007; Skinner, 1957). Verbal behaviors can also be broken into different classes or verbal operant of behavior based on the (a) motivating factors, (b) cue or prompt, and (c) response (Cooper et al., 2007; Lamarre & Holland, 1985; Sautter, & Leblanc, 2006; Skinner, 1957). The

verbal operant or class that requesting falls under is the mand. The mand is unique compared to other verbal operants because it primarily benefits the speaker, where all other verbal operants function mainly to service the listener (Cooper et al., 2007; Sautter, & Leblanc, 2006; Skinner 1957). Please refer to Figure 1 for a flow chart of Skinner’s verbal operants regarding the mand, tact, and echoic (Skinner, 1957; What is Verbal Behavior? n.d.).

Figure 1

Verbal Operants



Generally, in the ABA field, the mand is described as a verbal behavior that an individual engages in when the motivation is high to request something specific (i.e., an item, information, or activity) (Cooper et al., 2007; Lamarre & Holland, 1985; Sautter, & Leblanc, 2006; Skinner, 1957). This implies the strength of the reinforcement is relevant to the motivation operation (MO) for the mand verbal operant behavior (Cooper et al., 2007; Sautter, & Leblanc, 2006; Skinner 1957). Children with ASD often struggle with verbal behavior to some degree and these

communication issues can manifest from something as simple as being unable to express their wants and needs to more complicated intraverbal skills like being unable to answer a question in a conversation (Pellecchia & Hinline, 2007).

Typically, when teaching students with ASD communication skills, the mand is taught first in behavioral plans because it allows the student to immediately come in direct contact with the reinforcer and control the delivery of reinforcers (Cooper et al., 2007; Pellecchia & Hinline, 2007; Skinner, 1957). Consequently, this establishes a strong history and foundation of reinforcement for verbal communication behavior for the individual (Cooper et al., 2007; Pellecchia & Hinline, 2007). Manding increases future communication development and decreases undesired behaviors. Several studies have illustrated as manding and repertoire skills increase for individuals with ASD, their problem behavior decreases (Gutierrez et al. 2007; Madzharova et al., 2012; Winborn et al., 2002). Another vital feature of teaching manding to individuals with ASD is that the instructor must closely monitor the motivation operations of the student in their environment, which includes sedation or deprivation of the reinforcer (i.e., substances, information, or activity) (Carnett et al., 2017; Cooper et al., 2007).

Sundberg and Michel (2001) pointed out several concerns with mand training, the first being that mand training seems to be neglected with children with ASD (Skinner, 1957; Sundberg & Michel, 2001). It is presumed when a child learns an object's name by pointing at it (also referred to in ABA as tacting) that they will be able to generalize to being able to ask for it in the future when wanted with no further training or it being present; however, this does not occur for children with ASD (Skinner, 1957; Sundberg & Michel, 2001). Another concern of mand training is linked to using an incidental teaching approach, where the trainer relies on

naturally occurring motivating operations in a setting, which can result in insufficient variety or opportunities (Skinner, 1957; Sundberg & Michel, 2001).

Evidence-Based Practices (EBP). Verbal behavior (VB) therapy is often utilized to systematically teach verbal skills through mands, tacts, and other verbal operants using ABA principles (Haggerty, 2014; Sautter, & Leblanc, 2006; Skinner, 1957; Stock et al., 2013). VB therapy has three distinct characteristics, the first being the communication and verbal behavior instruction is derived explicitly from Skinner’s (1957) analysis of verbal behavior, specifically the functional nature of the mand, tact, and echoic to verbal language (Stock et al., 2013). In layman’s terms, VB teaches why we use words and how they are useful in making requests and communicating ideas (Skinner, 1957; Stock et al., 2013). The second attribute is VB instruction begins with teaching requesting behavior (mand) as the most basic type of language (e.g., a student learns that saying “cookie” can produce a cookie) (Stock et al., 2013). With VB the student is not required to say the item, but can still receive the reward by making a request using any means (e.g., pointing), which allows the student to learn the positive behavior contingency of communicating a request while their behavior is shaped into the targeted verbal behavior (Cooper et al., 2007; Stock et al., 2013). The final feature of VB is that it uses a technique called “errorless learning”, which is a procedure that uses immediate and frequent prompts to ensure the student provides the correct response each time (Stock et al., 2013). Over time the prompts are faded until the student no longer needs the prompting to provide the correct response (Cooper et al., 2007; Stock et al., 2013). A review conducted in 2006 that focused on only VB therapy intervention included 60 studies that concluded the intervention improved manding and other verbal operant behaviors in children with ASD (Sautter & Leblanc, 2006).

Mand Training. Mand training is an essential component of VB therapy and uses prompting, antecedent strategies, consequence strategies and reinforcement of requests to get preferred items or activities in a naturalistic setting (Albert et al., 2012; Lechago et al., 2010; Sundberg et al., 2002). According to Albert et al. (2012) the main two categories of mand training procedures can be broken down into antecedent or consequence strategies. When using antecedent strategies for mand training procedures, all teaching procedures are implemented before an individual's response (e.g. assessing reinforcement strength, manipulating reinforcers, and prompting) (Albert et al., 2012; Betz et al., 2010). Consequence strategies in mand training procedures, involve the contingent delivery of a specific consequence (e.g. item, attention, activity) to an explicit reinforcer and the mand topography (Albert et al., 2012; Betz et al., 2010).

In addition to the main two mand training categories, there are a few supplementary variations of mand training—one includes using interruption procedures where the item needed to complete the behavioral task is removed, which then requires the student to learn to make a request for the missing item (reinforced by requested item promptly given) to complete the task (Albert et al., 2012; Lechago et al., 2010). Albert et al. (2012) and Lechago et al. (2010) both conducted mand training with interrupted chain procedures and reported all participants with ASD were successfully taught to mand without prompts for missing items. For this research study it was decided mand training using both antecedent and consequence strategies (e.g. strong reinforcer used- miniature horse, prompting and specific items given for specific mand topography) with interruption chain procedure would be the best option to integrate into an EAL activity.

Equine-Assisted Activities and Therapy (EAAT)

Animal-Assisted Therapy: Horses Are Better

There are some non-ABA therapy options that use alternative methods, such as Animal-Assisted Therapy (AAT) and Equine-Assisted Activity and Therapies (EAAT). In recent years, there has been an increase in scholarly studies on animal-assisted interventions for individuals with ASD. To illustrate this increase, O'Haire (2013) completed a systematic review with the inclusion criterion of animal-assisted therapy and individuals with ASD and found 14 studies that were published between 2009-2014. Srinivasan, Cavagnino, and Bhat (2018) conducted a more recent review that further discovered 15 new studies had been published with nine of them being conducted within a four-year period (2013-2016). From these systematic reviews the reported results indicated that children with ASD initiated more communication contact and increased their engagement in social behavior (e.g., interacting with other people with eye contact and verbal behavior responses) in the presence of animals by 79%, whereas in the presence of toys and other inanimate objects children with ASD engaged in solitary behavior 94.3% of the time (O'Haire et al., 2013). It has been suggested that animals serve as a sort of social catalyst for communication and social interactions for individuals with ASD that facilitate deeper relationships with other individuals (Fine, 2015).

The biologist Wilson (1984) first suggested the Biophilia Hypothesis, which is defined as the predisposition of humans to be assimilated to animal life as a part of our evolutionary heritage, being a product of our evolution as omnivores alongside the animals and plants on which our survival depends. Essentially, Biophilia implies that humans do not necessarily have a love for animals but a unique instinctive interest in living things in general (Fine, 2015; Wilson, 1984). Subsequently, this leads to the strong belief that being in nature helps humans slow down and put things into perspective in a non-judgmental environment. It has also been suggested that because of Biophilia, humans have a natural drive and motivation to form relationships with

animals to obtain that closer kinship with nature (Fine, 2015; Wilson, 1984). When trying to understand why AAT's and EAAT's seem to have a positive impact, the Biophilia hypothesis provides researchers an overarching theoretical basis for these phenomena (Beck & Katcher, 2003; Fine, 2015; Wilson, 1984).

Equines are suggested to be the embodiment of the preferred therapy animal for several reasons. The horse, as a prey animal, is very sensitive and has a highly amplified flight or fight response; as such they can react to stimuli that a human could miss (Fine, 2015). This innate ability of the horse offers a valuable teaching tool because it can help teach students self-determination, self-efficacy, and trust as they identify and relate to the horse's need for trust and security within the herd (Masini, 2010). With the horse being such a sensitive prey animal, students must learn to communicate in a nonverbal fashion to ultimately build a working relationship with the horse to accomplish tasks and goals (Fine, 2015). Some studies have suggested the human-horse relationship is comparable to the therapist-client relationship in the mental health medical field (Fine, 2015; Karol, 2007). In essence, the horse is a living biofeedback monitor (i.e., they mirror our emotions) for humans in EAAT interactions and the catalyst between the therapist and the patient (Fine, 2015).

Another reason why horses are frequently sought out for animal-assisted therapy is the common characteristic of increased motivational operations for participants that comes with working with horses. It is often stated by students who participate in EAAT that it does not feel like a therapy session (EAGALA, 2010; PATH Intl, 2018). To illustrate, Isaacson (2009) proclaimed in his memoir, *The Horse Boy*, their child spoke his first words from the back of a horse (Fine, 2015). Rupert discussed in detail how Rowen, his son who was diagnosed with ASD with severe speech delay and behavioral deficits, was naturally drawn to horses (Fine, 2015;

Isaacson, 2009). He explained how Rowen seemed calmer (i.e., no screaming), learned to speak by giving verbal directives to the horse, and expressed enjoyment with laughter and smiles in the activities with the horse (Fine, 2015; Isaacson, 2009).

Historical Context of Equine Therapy

References to the therapeutic benefits of interacting with horses have appeared in the literature for centuries. In fact, as far back as the ancient Grecian era, physicians prescribed horseback riding for medical issues to improve a person's spirit and wellbeing (DePauw, 1986; Granados & Agis, 2011). However, some of the most significant findings on equine assisted therapy occurred in the last 80 years. After a polio outbreak in northern parts of Europe in the 1940s, the first organized therapeutic riding centers began to emerge (Snider et al., 2007).

Another reference to the therapeutic benefits of working with horses was demonstrated when Liz Hartel rode her horse, Jubilee, to win a silver Olympic medal in dressage; the first woman and polio patient to do so. She unknowingly promoted therapeutic riding worldwide by demonstrating the benefits and success of horseback riding for those with a disability (Depauw, 1986; Snider et al., 2007).

The Germans were the first to standardize therapeutic riding models and programs in the early 1960s. Their model covered medicine, psychology, education, and horsemanship that was designed to help students diagnosed with behavioral and emotional disorders (Fine, 2015; Sinder et al., 2007; Spink, 1993). The first organized horseback riding therapy programs did not occur in North America until 1965. By the 1970s, the Cheff Center in Michigan became the largest facility for therapeutic riding in the United States (Depauw, 1986). Today there are a variety of diversified programs all over the world. The umbrella term of EAAT encompasses specific types/forms of human-equine interactions to include therapeutic riding (TR), equine-assisted

learning/therapy (EAL/EAT), equine-assisted/facilitated psychotherapy (EAP/EFP), and hippotherapy (HPOT), as shown in Appendix H (Fine, 2015; Granados & Agis, 2011; Rigby & Grandjean, 2016; Smith-Osborne & Selby, 2010).

Development of Organizations

The horse's role in alternative therapy treatment originated from the physical benefits associated with riding the horse to now include the psychological and learning attributes from working with the horse on the ground in a variety of therapy activities. The therapeutic riding (TR) model that is most commonly used today originated from the British riding centers for the disabled (Fine, 2015). In 1969, the North American Riding for the Handicapped Association (NARHA) formalized the British model for their own association practices; they are now known as the Professional Association of Therapeutic Horsemanship International (PATH Intl.) (Fine, 2015; PATH Intl, 2018).

The PATH Intl TR approach offered therapeutic disciplines of both mounted and unmounted activities with the horse. This gave facilities the ability to focus and match the needs of the participant (Fine, 2015; PATH Intl, 2018). Then, other associations emerged, including the Equine Assisted Growth and Learning Association (EAGALA; 2010) and Certified Horsemanship Association (CHA; 2017). The EAGALA program's focus is strictly on the non-riding mental health aspects, whereas the CHA program's focus is on riding therapy, however CHA also includes non-disabled participants in their therapy programs. PATH Intl, being the oldest association, has both the non-riding mental health and therapy riding certification programs. In the past decade, several other programs have appeared, such as the O.K. Corral Series, which evolved from one of the founders of EAGALA, as shown in Appendix I (O.K. Corral Series, 2013).

Specific Therapies

Fine (2015) listed and defined the various terms and applications of EAAT. The most popular or most well-known is HPOT or hippotherapy, because HPOT is always conducted by a licensed physical, occupational, or speech-language pathologist who is also licensed as a Hippotherapy Clinical Specialist (HPCS) and utilizes the medical benefits of the horse's natural walking rhythm. This is the only equine therapy activity that can actually be prescribed by a physician at this time (AHA, 2016; Fine, 2015; PATH Intl, 2018).

Another common type of EAAT is therapeutic riding (TR), also referred to as equine-assisted activities (EAA), which includes activities like riding, horsemanship, and barn management skills (CHA, 2017; Fine, 2015; PATH Intl, 2018). There are also equine-assisted learning (EAL) and equine-assisted therapy (EAT); the only difference between the two is the equine-assisted therapy version must be recommended by a medical professional to facilitate rehabilitative goals for the patient (CHA, 2017; EAGALA, 2010; Fine, 2015; PATH Intl, 2018). Equine-assisted psychotherapy (EAP) is delivered by a licensed mental health professional, where the focus of the treatment is the psychosocial and behavioral aspects of interacting with the horse and a therapy-based treatment plan is followed (EAGALA, 2010; Fine, 2015; O.K. Corral Series, 2013). The last two types of EAAT are the least common of the available programs. Therapeutic carriage driving (TCD) is a similar program to EAA and TR, only it has been adapted for those participants that are unable to ride and instead interact with a horse through driving (Fine, 2015; PATH Intl, 2018). Therapeutic vaulting (TV) involves the participants learning and performing precise strategic movements on and around the horse to build core and motor function skills (Fine, 2015; PATH Intl, 2018).

Non-Riding Therapy. When EAAT therapy is mentioned, riding therapy is the most common type of EAAT that comes to mind. However, there are various non-riding learning activities that also constitute as therapy sessions due to the psychological connection that occurs when working with a living animal (EAGALA, 2010; Fine, 2015; PATH Intl, 2018). This psychological connection can occur on a subconscious level with simple body language between an individual and a horse (EAGALA, 2010; Fine, 2015). Several studies that measured the impact of working with a horse in unmounted sessions presented results suggesting an individual can benefit from just being in the presence of a horse from the psychological calming effect that reduces anxiety and cortisol levels, and improves emotional states (Klontz et al., 2007; Yorke et al., 2008; Yorke et al., 2013).

Research-Based Practices

According to Fine (2015) all types of EAAT are still considered an alternative intervention or research-based practice due to the lack of rigor of research studies not the dearth. Despite these issues EAAT is a frequent topic in current research studies. One comprehensive review conducted by Mapes and Rosén (2016) analyzed 12 studies all conducted within the past five years that utilized EAAT as an intervention for students with ASD. Of those 12 studies researched, 11 studies revealed EAAT intervention effectiveness for increased communication, social functioning, sensory sensitivity, self-regulation, adaptive skills, motor skills, improved volition, and decreased aberrant behavior (Mapes & Rosén, 2016). A different review conducted by Fine (2015) found 26 studies that occurred within a 10-year span (2003-2013) and over half of them reported findings of increases in social communication skills, verbalization, and in initiating verbal communication behavior for participants with disabilities to include ASD.

In a more recent review of the EAAT and ASD literature, the authors reported that 15 of the 18 studies found a functional relation between the EAAT intervention and verbal communication and social behavior improvement (Tan & Simmonds, 2018). Another systematic mapping review on using EAAT interventions for participants diagnosed with ASD conducted by McDaniel Peters and Wood (2017) reviewed 28 studies and found one of the most commonly measured outcomes in 25 of the studies was interpersonal interactions; this was frequently measured through assessments that measure verbal behavior to include receptive and expressive communication like manding. Overall, it was found the outcomes for communication and social behavior when implementing an EAAT intervention for participants with ASD to be consistent with previous systematic literature reviews of improvement in communication behavior (McDaniel Peters & Wood, 2017). It was also reported from these EAAT studies that the therapies varied from version being used to facility presenting the therapy, and each focused on different outcomes for the patient. However, what was similar as that all EAAT programs used the horse as the facilitator for change and goal attainment, regardless if the subjects were riding the horse or working with the horse on the ground in a non-riding therapy activity (Fine, 2015).

With all the various types of EAAT interventions available, I decided the EAL version was the best alternative therapy to integrate with ABA techniques to implement as an intervention. This decision was made for several reasons, one being EAL, unlike EAT, EAP or HPOT, does not require licensed medical personnel to administer the intervention. Another reason is the selected site chosen to conduct the research, which is a hospital-like facility where utilizing full-size horses and the riding aspect of certain EAAT therapies is not feasible. EAL is perfect in a hospital or clinical setting because, in size, the miniature therapy horses are approximately the same as a medium sized dog.

Combining of Therapies: HPOT, the Success Story

Why Combining Worked

In 1973, a licensed physical therapist watched a film at a PATH Intl (known back then as NARHA) meeting in Washington, DC, that focused on how riding horses was not only fun but therapeutic (AHA, 2016). This film then led Barbara Glasow, now the most renowned physical therapist and HPCS, on an unprecedented journey. After graduating physical therapy (PT) school and becoming a licensed PT, Glasow started offering her services as a consultant to a therapeutic riding program (AHA, 2016).

Within just a few years, she radically altered their approach by removing saddles and reins and replacing them with pads and straps to be able to target and strengthen balance, core muscles, symmetry, alignment, and postural control (AHA, 2016). This created a stir in the therapeutic riding community as previously contraptions and supports were being created and used to allow individuals with disabilities to participate in horseback riding (AHA, 2016). The thought of completely removing the supports and rigging up pads and straps to enable the therapist to focus on building muscle strength and increasing flexibility for a rider with a disability was a completely foreign idea (AHA, 2016). By 1987, a group of 18 American and Canadian physical therapists went to Germany to study HPOT and to construct the first curriculum (AHA, 2016). Not long after, the first HPOT committee and association was created to standardize and develop the curriculum (AHA, 2016). By 1999, The American Hippotherapy Certification Board was established and the first Hippotherapy Clinical Specialists (HPCS) examination was administered (AHA, 2016). Today, HPOT is widely accepted and recognized by the American Physical Therapy Association (APTA), the American Occupational Therapy

Association (AOTA), and the American Speech and Hearing Association (ASHA) as a part of a patient's integrated treatment plan (AHA, 2016).

Limitations of One Therapy in Isolation

Each therapy alone, such as physical therapy or equine therapy, has benefits as well as limitations, but together—as with HPOT—they increase their benefits for the recipient (AHA, 2016). This is similar to ABA and EAAT, while each have a multitude of benefits for the recipient alone, as “therapy silos” they are limited in certain outcome areas that can end up being significant for a recipient. For example, a limitation to ABA as an evidence-based therapy with its rigorous techniques is that it feels too much like therapy. The recipient may not be so receptive with a decrease in motivational operation when working with inanimate objects, thus limiting the overall outcomes. This receptiveness has been shown in one study that compared working with real live dogs versus a robotic inanimate version, where the outcomes indicated the participants were more responsive and engaged with the live dog compared to the robotic version (Fine, 2015; Melson et al., 2009).

Conversely, EAAT is far from feeling like a routine therapy session and, in fact, has been reported in various studies that children with ASD found these therapy lessons to be enjoyable and an exciting experience, increasing the recipients' interest to participate in the activities (Mapes & Rosén, 2016; McDaniel Peters & Wood, 2017). Additionally, ABA interventions tend to incorporate toys and inanimate objects as reinforcers to teach target behavior and it has been shown using animals such as horses has a greater response and more positive outcomes in studies when compared to inanimate objects such as toys (O'Haire et al., 2013).

However, EAAT lacks the rigor and evidence-based techniques that ABA has in standardizing teaching certain behavioral skills like manding. For example, one of the main

occurring themes among the systematic review studies utilizing EAAT as an intervention was the procedures for the EAAT interventions were not systematic and were not explicitly stated for replication purposes, which resulted in being a limitation to the study (Fine, 2015; Mapes & Rosén, 2016; O'Haire, 2013; Srinivasan et al., 2018). By combining the two therapies together they eliminate each other's weaknesses through their own strengths. Thus, the behavioral deficits associated with ASD, such as the lack of verbal skills such as manding, have only fueled and expanded the fields of ABA and EAAT to provide support and teach functional behaviors to give students with ASD the tools and skills they need to lead a typical lifestyle as possible in their communities (Fine, 2015; Westling et al., 2015). It is with that perspective that research needs to be conducted on the combination of ABA and EAAT therapies for participants with ASD to provide definitive results on teaching behaviors and skills like manding.

Chapter 3

Methodology

Purpose of the Study

The U.S. Department of Education and The Center for Disease Control and Prevention (CDC) have reported the autism spectrum disorder (ASD) prevalence estimate has increased to 1 in 54 children aged 8 years that are identified with ASD (Baio et al. 2018; CDC, 2018; U.S. Department of Education, 2017). This increase has placed a demand for best Evidence-Based Practices (EBP) in teaching children with ASD to include applied behavioral analysis (ABA) strategies, such as mand training and interrupt chain procedures, as well as other therapy options, such as equine assisted activities and therapies (EAAT), to better serve and reach non-responders (Fine, 2015; Westling et al., 2015). ASD is characterized by marked deficits in socialization, behavior, and communication; while some of these characteristics are common, they are not necessarily exhibited by all individuals on the spectrum (CDC, 2018; Tan & Simmonds, 2018; Westling et al., 2015).

Numerous research studies using ABA and EAAT interventions have reported positive outcomes on verbal communication for individuals with ASD (Cooper et al., 2007; Fine, 2015; Ward et al., 2013; Winborn et al., 2002). Predominantly due to Skinner's (1957) research on verbal behavior, ABA practices such as mand training are well-established evidence-based interventions for teaching children with ASD communication. In the animal therapy field EAAT is currently recognized as the most effective animal-assisted therapy (AAT) for children with ASD and was shown in a comprehensive review that 11 of the 12 studies analyzed reported improvement in communication (Borgi et al., 2016; Mapes & Rosén, 2016). However, the ABA strategy of mand training has never been adapted to be integrated in an EAL activity the way

physical therapy was integrated to develop hippotherapy (HPOT), a now widely accepted treatment plan by various therapy associations (AHA, 2016; Fine, 2015). From the support of the current literature on ABA and EAAT interventions I developed a hypothesis with the belief that combining the two therapies as one intervention package would have a positive impact on verbal manding outcomes for children with ASD (Cooper et al., 2007; Fine, 2015; Holm et al., 2014; Sundberg, & Michael, 2001). The mand training and interrupted chain procedures used in this study were similar to those used by Albert et al. (2012), Betz et al. (2010), Lechago et al. (2010), and Sundberg et al. (2002) with children diagnosed with ASD and with limited verbal manding levels, however this study also used an EAL activity.

The purpose of this study is to examine whether there is a functional relation between mand training integrated with an EAL activity and manding behaviors in individuals with ASD. This study will also add to the literature on conducting studies at medical facilities with outpatients and bringing equine-assisted miniature horses to participants at the facility as well as integrating mand training with an EAL activity (Cooper et al., 2007; Fine, 2015). To answer the following research questions, I adapted a mand training and interruption chain procedure intervention from a previous study and integrated it into an EAL activity with the approval of a licensed board-certified behavior analyst (BCBA) (Fine, 2015). EAL was chosen out of all the different EAAT programs because EAL is an educational approach similar to equine assisted therapy (EAT), which utilizes non-riding activities to facilitate learning with a horse without the need of a licensed medical professional (EAGALA, 2010; Fine, 2015; PATH Intl, 2018).

Research Questions

1. Is there a functional relation between mand training with interrupted chain procedures integrated in an EAL activity and an increased mean level change of independent verbal manding behavior for students identified with ASD and limited manding behavior?
2. Is there a functional relation between mand training with interrupted chain procedures integrated into an EAL activity and a decreased mean level change of problem behavior for students identified with ASD and limited manding behavior?
3. Do effects maintain one-month post intervention (e.g., regression of one or less manding level)?
4. Do effects of mand training with interrupted chain procedures integrated into an EAL activity generalize to different conditions (e.g., new stimulus)?

Settings

All phases of the study took place in one setting at a state-run facility for children with developmental disability needs. The facility had some children who were admitted to the facility for a minimum 30-day stay or longer and some of these children that lived at the facility were wards of the state. The facility also had a therapy department that provided outpatient services to many children from the community. One side of the facility's campus had six houses where the in-patient children lived with 24-hour care. The houses where the children lived had up to 6 bedrooms with a max of two children per room. Each bedroom had a bathroom with a sink and toilet. Each house had a communal shower/bathroom along with a laundry room and kitchen area that was always kept locked. At the front of the house was the nurse's station; most houses shared a nurse between them unless more medical supports were needed. All house doors to the outside were always kept locked and could only be opened with an employee's badge. All the

houses were located on the north side of the facility in a semicircle fashion with the back of each house leading out to a communal playground that lead to the facility's school.

The school had three classrooms divided into elementary, middle school, and high school age groups with one special education teacher and paraprofessional in addition to each child's caretaker (2 children per 1 caretaker). Each classroom had its own bathroom and was equipped with age-appropriate items like desks, pictures, puzzle work boxes, and manipulates. The cafeteria/gym area where all students attended lunch together during school days was in the center of the school. The front of the schoolhouse housed several administrative offices as well as a sensory room with a variety of sensory activities and items in the room.

The administration and therapy building were southwest of the school and houses. The employee cafeteria and conference rooms were located on the north side of the building which then lead into where all administration offices for nurses, social work, volunteering, and human resources staff were located. This area was also where all intake and neurobehavioral clinic activities took place. The facility dedicated a large portion of the administration building to their Department of Social Work. This was due to the high percentage of inpatients at the facility being in the foster care system. Each foster care student was assigned to one of the facilities social worker's caseload to ensure the student received all the services they needed as well as act as their liaison to Department of Health Services (DHS) and legal court system. During the recruitment period of this study this was the department that assisted with the DHS IRB.

The southeast side of the building housed the large main therapy room and several small therapy rooms. The southwest side housed one large office with the speech therapists, occupational therapists, and physical therapists' cubicles. The therapy services provided by the facility were available to inpatient as well as outpatient children within the community. This

study was conducted in a designated therapy room typically used to conduct their summer camps. The building was separate from the rest of the facility and had an open concept with a kitchenette and bathroom facilities. The rest of the room was a large open room and cleared of any distracting items to provide plenty of room to work with a miniature horse for the EAL activity being used with mand training and interruption procedures.

There are 32 children that are inpatients at the medical facility at any given time. The ages ranged from 4 to 18 years of age. Children admitted to the medical facility are required to stay for a minimum of 30 days or longer. There are numerous staff members at the facility that work with the children throughout their stay. First, there are the caretakers who are required to hold a minimum of a high school diploma, no certification required, and they receive basic HIPAA and caretaker training at the facility. There are three caretaker shifts: (a) day shift from 7am to 3pm, (b) swing shift from 3pm to 12am, (c) night shift from 12am to 7am. There are nurses assigned to the houses, usually one for every two houses, and all nurses are licensed registered nurses (RNs) who interact with the children daily via administering their medications and checking their vitals (if a fragile health case) throughout the day.

Each of the three classrooms on the facility's campus has an assigned teacher and a paraprofessional who are employed through the local school district. The teachers are required to have their teaching certificate in special education and the paraprofessionals must have a high school diploma. There are several speech language pathologists (SLP), occupational therapists (OT), and physical therapists (PT) located in the therapy wing of the main facility's administrative building who not only provide services to all the inpatient children but also provide service to outpatient children ages 0 to 21 years of age. All OTs and PTs are required to have a master's degree and a license in their respective fields. Physical therapists are required to

have a doctoral degree and a license to practice in their field. The therapy wing of the facility is open from 8 am to 5 pm Monday through Friday. Finally, there are numerous administrative and support staff located in the other wing of the administrative building. The education requirements range from high school diploma to doctoral degree, depending on the requirements of the job position.

EAAT Therapist

For EAAT therapy accreditation there are different programs available, such as (a) Professional Association of Therapeutic Horsemanship International (PATH Intl.), (b) Equine Assisted Growth and Learning Association (EAGALA), (c) American Hippotherapy Association (AHA), (d) Certified Horsemanship Association (CHA), and (e) O.K. Corral Series, which award certification as an Instructor of Riders with Disabilities. One EAL provider assisted with implementing the EAL intervention portion. The EAL instructor was certified through the O.K. Corral Series and had several years of experience as an EAL instructor (AHA, 2016; CHA, 2017; EAGALA, 2010; O.K. Corral Series, 2013; PATH Intl., 2018). The EAL instructor had several years' experience working with students with ASD within a non-profit program. However, since the EAL instructor had no experience with ABA, the ABA portion of the intervention was implemented by the researcher and supervised by a BCBA-D.

Selection Process

Inclusion and Exclusion Criteria

The following criteria were used to identify potential participants for this study (1) diagnosed by a medical professional using the criteria for ASD level II established by the DSM-V, (2) identified (by parents) as having low to limited manding verbal behavior, (3) needed to have the prerequisite skill of being able to tact for basic items of the EAL activity (e.g., brush,

bow, beads), (4) required to be either inpatient or outpatient of the medical facility, (5) needed to be mobile and had no known allergies to animals, (6) and agreed to participate in the learning activity with the miniature horse by choosing the picture that displayed the horse activity.

DSM-V Severity Levels

The DSM-V breaks ASD into three severity categories. In level I social communication is described that without support in place, deficits in social communication are noticeable and individuals with ASD may appear to have decreased interest in social interactions (APA, 2013). In level II social communication in individuals with ASD have apparent deficits in verbal and non-verbal social communication skills, even with supports in place (APA, 2013). Level III is the most severe level for communication skills for individuals with ASD. At this level there are severe verbal and nonverbal deficits in social communication skills caused by severe impairments in functioning and minimal social overtures from others (APA, 2013).

Participants

Originally, the researcher tried to include in-patient participants who were also wards of the state to provide a solid sampling from all populations at the medical facility. The study cleared OU's IRB, but the DHS IRB process impeded the ability for the study to be carried out (i.e., 6 months). The head investigator decided to proceed with the study, including only outpatient participants that received therapy services from the medical facility.

In the beginning of the study, six participants were identified as interested in participating in the study and met all the inclusion criteria of this study. The age range was from four years old to 13 years old. Two males were Hispanic, one male was African American, another male was Native American, and the remaining two participants were Caucasian. The sixth participant never came to any of the sessions and eventually left the study altogether for personal family

reasons. All participants were reported to use at least 1-2-word sentences and had the capability to mand for items that were not present in the environment. Additional background information was obtained from each of the participant's families.

Participant One

Participant One was a four-year-old male of Hispanic descent. He was diagnosed with ASD by his family doctor at age two but had only been receiving speech-language pathologist (SLP) services at the medical facility for a year. He was too young to attend the public school; however, he was receiving ABA services at home. According to parents, his current verbal language profile was limited and often echoic or repetitive. Participant One communicated using 1-2 word sentences or phases and would mand for items but only if visible. His parents also noted he had sensory issues and a short attention span. In addition, they stated that even though he seemed to be a very happy child if he did not get his way or did not want to do something, he was prone to show problem behavior such as biting, hitting, and elopement. Finally, his parents reported he had only been exposed to horses at a petting zoo once and seemed to like feeding them treats.

Participant Two

Participant Two was a 13-year-old male also of Hispanic descent. Parents reported he was diagnosed with ASD by his family medical doctor; however, they could not remember what age this had occurred. At the time of the study, he had been receiving SLP services at the medical facility for several years and had been attending the local public school with services under IDEA (2004) for ASD. The parents reported their child had several health issues, including severe anxiety and connection issues with other people and animals, and heart issues with three previous open-heart surgeries. Parents reported his current verbal language profile consisted of a

large vocabulary; however, he would use his words inappropriately or not at all (e.g. grabbed things right out of people's hands instead of asking for the item). Participant Two had the ability to communicate using complex sentences, often five words or more and could mand for items that were not visible. He had no known experience with horses at the time of the study.

Participant Three

Participant Three was a six-year-old male of Caucasian descent. He was diagnosed with ASD at the age of two by his family doctor. His family reported he had been receiving SLP services at the medical facility for at least a year because of his lack of verbal behavior acquisition. Participant Three communicated using 1-2 word sentences and he could mand for items via repeating the request if verbally prompted and shown item, it also had to be a strong reinforcer for him (e.g., candy). His family also reported he had sensory and feeding issues. They stated most of the time he was upset, anxious, and struggled to follow directions as well as make connections with people and animals. His family also noted he sometimes wanted to run away from a task and needed the constant support of an adult. He was attending the local public school and was identified through IDEA (2004) with ASD. This participant had no known experience with horses at the time of the study.

Participant Four

Participant Four was a 6-year-old male of Native American descent. He was diagnosed with ASD and attention deficit hyperactivity disorder (ADHD) by his family doctor at age two and had been receiving SLP services at the medical facility for at least a year. His parents stated he struggled with lack of focus and had problems with verbally communicating (e.g., echoic and repetitive verbal behavior). Participant Four communicated using 2-4 word sentences and could mand for items if the item was visible. They also said he had separation anxiety and would often

elope from a task or area to gain attention. He attended the local public school and received IEP services under ASD and ADHD. The parents stated he loved horses and had been exposed to them when he was younger when his mom had owned a horse.

Participant Five

Participant Five was a seven-year-old female of Caucasian descent. She was diagnosed with ASD by her family doctor and had been receiving SLP services at the medical facility for two years due to her lack of verbal behavior acquisition (e.g., no verbal response or echoic). Participant Five communication ability consisted of using 2- 3 word sentences and she was capable of manding for an item if verbally prompted and was shown item. She also attended the local public school and received services under IDEA (2004) for ASD. Her parents stated she had a low attention span and could display behaviors of self-abuse and screaming when she wanted to escape a task or out of frustration. Parents also noted she was deathly afraid of dogs but showed no fear towards horses regardless of size. Her experience with horses included local petting zoos and visiting a family friend's farm.

Single Case Experimental Design (SCED)

Single-case experimental design (SCED) was developed to provide practitioners a means to study and focus on the individual (Gast & Ledford, 2014; Kratochwill et al., 2010). When an intervention is implemented a SCED allows the researcher to be able to attribute a functional relation between the independent variable (intervention) and dependent variable (targeted behavior) on a singular participant and allow fine grain observation of an individual participant's responsiveness to the intervention across time (Barlow et al., 2009; Gast & Ledford, 2014; Kratochwill et al., 2010). SCED is also feasible for studying populations consisting of small numbers of individuals (Gast & Ledford, 2014; Kratochwill et al., 2010). For this study to

successfully analyze any functional relation between the targeted verbal manding behavior amongst five individuals with ASD and the proposed intervention, a SCED was chosen due to its sensitivity to individual differences and the population targeted (Barlow et al., 2009; Gast & Ledford, 2014; Kratochwill et al., 2010).

Design Selection

Another matter that was considered during the selection of the research design was the targeted behavior of manding. Manding is a learned verbal operant behavior that once learned can regress, however, the learned behavior stays in the individual's behavioral repertoire (Cooper et al., 2007; Skinner, 1957). Therefore, a withdrawal or a reversal design was not the best fit to answer the proposed research questions (Cooper et al., 2007; Sidman, 1960). Ethical consideration also became a concern with regard to withdrawing a seemingly effective intervention for such a pivotal behavior that contributes to the overall functionality of the individual in society (Barlow et al., 2009; Cooper et al., 2007; Tawney & Gast, 1984).

Multiple Baseline

Multiple baseline designs were first presented by Baer, Wolf, and Risely (1968) as an alternative to the reversal design for two problem situations, where learned behavior is irreversible and when it is unethical to reverse conditions. They described the basic operation of a multiple baseline design as the time-lagged implementation of treatment (independent variable) across theoretically different behaviors, participants, or environments (Baer et al., 1968; Barlow et al., 2009; Cooper et al., 2007). With the concerns of attrition, reactivity to controls, interaction of time of measurement and treatment effects, and reaction effects of experimental arrangements (due to the novelty of working with the miniature horse), a multiple-

baseline design across participants was chosen for this study (Barlow et al., 2009; Christ, 2007; Gast & Ledford, 2014; Kratochwill et al., 2010). In addition, this design:

- Provides the opportunity to investigate the effect of the intervention across participants comprehensively.
- Does not require a return to baseline to corroborate the effectiveness of the intervention.
- Allows researchers to measure the outcomes of the intervention on different subjects (Barlow et al., 2009; Christ, 2007; Gast & Ledford, 2014; Kratochwill et al., 2010).

Design Standards

To ensure the study met the highest standards for conducting a single-case multiple baseline design across participants I adhered to the design standards recommended from the What Works Clearinghouse (WWC) (Kratochwill et al., 2010; WWC, 2017). The WWC design standards state (a) the independent variable (intervention) must be systematically manipulated, (b) inter-observer agreement (IOA) needs to be collected for a minimum of 20% of the data points for each phase and meet the minimal threshold of 80%, (c) researchers need to demonstrate at least three attempts of an intervention effect with three different phase repetitions or at three different points of time, (d) and a minimum of three or more data points at a stable state are required for the phase to qualify as an attempt to demonstrate an effect, though WWC states specifically for multiple baseline and multiple probe (a variant of multiple baseline) designs to have a minimum of five data points per phase with a minimum of six phases to be rated meets *WWC SCD Standards* (Kratochwill et al., 2010; WWC, 2017).

In the current study, the intervention was systematically manipulated by the researcher, following explicit procedures to analyze its impact on the dependent variables. The baseline and intervention phase for all participants had a minimum of five data points at steady response state and the study was replicated across a minimum of three participants or more. This was done to ensure meeting the requirement of attempting to establish experimental control at three different points in time. In addition, IOA was collected for 30% of all data points in each phase and 30% of the intervention phase was checked for implementation fidelity. Furthermore, all additional WWC requirements were met for multiple baseline designs to include staggering the start of the intervention for each participant and each participant had a probe session when the intervention was introduced to another participant. By following these protocols this research study meets the WWC design standards described in the *What Works Clearinghouse Standards Handbook* (Kratochwill et al., 2010; WWC, 2017).

Dependent Variables

To conform to the WWC design standards for SCED the main and secondary dependent variables were operationally defined, measured frequently, measured consistently through each experimental phase, assessed for reliability by multiple observers, and had a high social validity (Horner et al., 2012; Kratochwill et al., 2010; WWC, 2017). The main dependent variable was the type (independent, prompted, or no/wrong response) of manding verbal behavior, which was operationally defined as a verbal request using correct “vocal mand topography” for a specific item that was wanted or needed to complete the behavior chain of the EAL activity, either independently, with a specific prompt, or no/wrong response. For this study specifically, prompting was only coded if they needed to verbally hear the correct vocal mand topography for the required item and/or have the instructor gesture and show the correct item.

In the ABA field, the mand is defined as a verbal behavior that an individual engages in when the motivation operation (MO) is high to request something specific (i.e., an item, information, or activity) (Cooper et al., 2007; Lamarre & Holland, 1985; Sautter, & Leblanc, 2006; Skinner, 1957). The mand is generally taught first in behavioral plans because it allows the student to immediately come in direct contact with the reinforcer as well as control the delivery of reinforcers (Cooper et al., 2007; Pellecchia & Hine, 2007; Skinner, 1957). Skinner (1957) also stated verbal behavior to include manding is a learned behavior; therefore, by default, it cannot be unlearned.

The secondary dependent variable was problem behavior. To capture the variety of behaviors exhibited by the various participants it was broadly operationally defined. Problem behavior included crying, screaming, hitting, throwing materials, elopement, non-contextual vocalizations, and any self-stimulatory behavior (Cooper et al., 2007; Jennett et al., 2008). Since each participant displays problem behavior differently, each participant's problem behavior is defined individually in a function-based manner.

For Participant 1 problem behavior is defined as any instance during the "dress the horse" task where the child bites, hits, or elopes out of the defined work area (fenced area). Participant 2's problem behavior was non-compliance and it was defined as any instance during the "dress the horse" task where the child ignores the instructor's prompt to ask for items and instead grabs or reaches for items without asking. Participant 3's problem behavior was defined as any instance during the "dress the horse" task that the child engaged in either behavior of hitting oneself or eloping from the defined work area (fenced area). For Participant 4 problem behavior was defined as any instance during the "dress the horse" task the child engaged in elopement from the work area (fenced in area) either to escape the task or to gain attention. The problem

behavior for Participant 5 was also non-compliance, but for this participant it was defined as any instance during the “dress the horse” task where the child ignored the instructor prompts and continued to engage in other behavior (i.e., play with curtains, playing with item or putting it on themselves instead of putting it on the horse).

Data Collection

Measurement

All sessions were video recorded with the consent of participants parents to create a permanent product for the purposes to be coded later for both dependent variables as well as fidelity and IOA coding. The main dependent variable of study was the type of mand response, which was scored either as independent, prompted, or no response. An independent mand response was defined as the participant emitting the targeted vocal mand topography, or close approximation (shaping), for an item, such as “br” for “brush” within a 10-s delay interval in the absence of a vocal (topography of specific item) prompt and without the instructor gesturing and showing the relevant item, and these were coded specifically for this study as (IM) on the data collection sheet. A prompted vocal mand for a required missing item needed to complete the behavior chain was defined explicitly for this study as the participant emitting the correct targeted vocal mand after the interventionist provided a verbal (topography of specific item) or visual (gestured and showed specific item) prompt of required item; only these specific prompts were coded as (P) on the data collection sheet. The definition for the no response code was the participant emitting either no response or any response other than the targeted vocal mand topography within the 10-s delay interval with or without a prompt assistance; these were coded with an (NR) on the data collection sheet (Albert et al., 2012; Betz et al., 2010; Lechago et al., 2010; Sundberg et al., 2002).

It is important for this study to clarify the differences between a spontaneous mand versus an independent mand in verbal behavior. Spontaneous mand occurs when an individual's request for an item is an impulse without any stimuli or prompts (Sundberg, 2008; Sweeney-Kerwin et al., 2007). Where an independent prompt is still considered independent even in the presence of the stimuli the difference is no clues or help (e.g. verbal prompts such as sounding out the first sound of the word or gestural prompts such as pointing or showing item) is given for the correct verbal response (Sundberg, 2008; Sweeney-Kerwin et al., 2007). It is also important for this study to clarify the difference between an instruction versus a prompt in verbal behavior. An instruction is when the instructor gives direction to complete a task (e.g. what's next) versus a prompt where a clue (e.g. either the beginning sound "c" for cup or gesture [pointing] at cup) is given for correct verbal response (Sundberg, 2008; Sweeney-Kerwin et al., 2007). For the purpose of this study only the independent mand (including approximation), prompted (only verbal topography of item and or gestural with visual topography of item), and no response (including wrong response with or without prompt) manding types were recorded. The levels of prompts or prompted responses that were echoic or tacting were not targeted for this study due to time and resource constraints.

For the secondary dependent variable of problem behavior each video was coded using a 30-second partial interval procedure. Thirty-second time intervals were chosen due to the short length (3 to 4 minutes) of each session. Shortening the intervals provided more opportunities to observe the targeted behavior (Cooper et al., 2007). According to Cooper et al. 2007, partial interval recording is a time sampling method for measuring behaviors in segmented observation periods called intervals. All intervals are required to be the same length of time. The behavior is recorded if the target behavior occurs anytime during the interval. With partial interval recording

data it is reported as a percentage of total intervals in which the target behavior was scored (Cooper et al., 2007). Partial interval recording was chosen instead of whole interval or momentary time sampling because of the targeted behaviors occurring so quickly (1 second). In addition, Cooper et al. (2007) recommended using partial interval recording when the goal is to decrease a target behavior because it overestimates the duration of the behavior.

Independent Variable

Mand Training

Mand training (using both types antecedent and consequence strategies) with interrupted chain procedures similar to those used by Albert et al. (2012), Betz et al. (2010), Lechago et al. (2010), and Sundberg et al. (2002) were used, but were integrated with an EAL activity (dress up the miniature pony activity) as the intervention for this study. The components of this particular intervention were selected to provide naturalistic opportunities for the participant to either mand or be prompted to mand for items (e.g., brush, bow, and clip) during a strong reinforcing activity (playing with miniature horse). Intervention procedural task-analysis was followed as shown in Appendix B. The intervention was implemented in a one-on-one capacity with the interventionist (interventionist was the primary researcher) and one certified EAL instructor whose purpose was to ensure the EAL portion of the intervention was implemented properly and to handle the horse. Each probe session lasted on average about 5 minutes for each of the five participants and the frequency of the intervention was twice a week. The duration of the intervention was a minimum of five probe sessions or more with a final generalization probe; then, an additional maintenance probe was collected after a specified length of time after the intervention was withdrawn.

The interventionist was highly qualified to implement the intervention. She has a master's degree in special education and has several years' experience as a special education teacher. She is currently in a special education and ABA doctoral program and is a registered behavior technician being supervised by a Board-Certified Behavior Analyst for field hours. In addition, the interventionist has extensive knowledge on horses and EAAT from owning her own horses and from volunteer hours she has accumulated towards acquiring a certification in EAAT.

Behavior Chain

Materials

Materials that were used for this study consisted of items needed for the behavior chain to complete the "dress up your miniature horse" EAL activity, which included a dress-up box that housed a variety of brushes, bows, clips, beads, and clothes. A behavior chain was developed with specific sequencing steps to complete the EAL activity, which is displayed in Appendix C. A miniature horse specifically trained to perform EAL activities was used, along with its halter, lead rope, harness, and horse treats. Other materials used during the study included timers, video recorder, a video model of the activity, field notes, and procedural checklists for intervention implementation, fidelity, and inter-observer scoresheets.

Procedures

Pre-training

The interventionist and the EAL instructor set up all materials needed to complete the EAL activity in a therapy room designated at the medical facility. During the pretraining condition each participant was taught the response chain on how to complete the EAL activity of dressing the miniature horse using the procedural task analysis from Appendix A and the

behavior chain from Appendix C. The pre-training consisted of a model phase where the interventionist gave the verbal instruction “dress horse” and then proceeded to use a total-task presentation (Albert et al., 2012; Cooper et al., 2007; Sundberg et al., 2002). After the pre-training, session baseline data was collected for all participants.

Baseline

Baseline sessions were conducted twice a week for each participant. The arrangement was the same as the pre-training phase, except the behavior sequence to complete the task was no longer modeled for the participant (refer to Appendix A). The required items to complete the behavior chain for the EAL activity were presented, but out of reach of the participant. The interventionist started the behavior chain by providing the same verbal instruction of “dress horse” used in the pre-training. The participants then completed each step of the behavior chain by manding for each item. If the participant responded incorrectly or provided no response at all, the interventionist corrected the participant with the correct verbal topography for the item to ensure the participant completed each step correctly (Albert et al., 2012; Sundberg et al., 2002). Once a minimum of five baseline sessions were completed and a steady state of responding had been achieved under baseline conditions for the first participant, the intervention was introduced while the rest of the participants continued with the baseline condition. Steady state responding strategy is defined as a pattern of responses in which there is very little variation in the measured dimensions of the behavior over a specific time period (Cooper et al. 2007; Johnson & Pennypacker, 2009).

Intervention

The intervention condition was set up exactly the same as the baseline conditions and consisted of mand training with interruption chain procedures to teach each participant mands for

missing items of the EAL activity. The differences during the intervention condition consisted of interrupting the behavior chains by removing items (e.g., box out of sight) needed to complete the EAL activity in the correct sequence and providing a 10s waiting period to allow ample opportunity to independently mand for the item (Albert et al., 2012; Sundberg et al., 2002). See Appendix B for a summary of the procedural task analysis that was followed for every session and Appendix C for items removed listed in boldface.

The interventionist provided the same verbal instruction of “dress horse” as in the previous conditions with a wait period of 10s to provide the participant an opportunity to respond independently. After the 10s-wait period, if the participant emitted any response other than the targeted vocal mand topography, a verbal prompt or gestural with visual prompt was provided for the missing item. If the participant echoed the vocal prompt the interventionist immediately reinforced the behavior with the missing item and provided praise for the manding behavior. These same procedures were repeated for the entire behavior chain required to complete the EAL activity (Albert et al., 2012; Sundberg et al., 2002). The intervention was then introduced to each consecutive participant, pending the stability of their baseline data, once the intervention showed steady change in the manding behavior of the prior participant (Cooper et al., 2007; Kratochwill et al., 2010; WWC, 2017). The intervention was withdrawn once the last participant had completed the intervention phase.

Maintenance and Generalization

Maintenance and generalization probes were taken during this study for each participant. A maintenance probe is administered to determine if there is a lasting change in the targeted behavior following the removal of the intervention (Cooper et al., 2007). A generalization probe is conducted to evaluate if the trained targeted behavior occurs in the presence of a new stimulus

condition (e.g., setting, instructor, item, activity) that was not used during the training/intervention phase (Cooper et al., 2007).

Following the withdrawal of the intervention for a minimum of three weeks a maintenance probe was taken for each participant. The maintenance probe condition was set up exactly like all the previous conditions. The interventionist followed the same procedures as the intervention condition to determine whether the participants maintained their levels of manding behavior from the previous condition (Albert et al., 2012; Sundberg et al., 2002). For the generalization probe each participant was assessed on the same behavior chain for the EAL activity immediately following the end of the intervention to determine if they would mand for the same absent items under different conditions, in this case a toy horse the same size as the miniature horse (Albert et al., 2012; Betz et al., 2010; Sundberg et al., 2002). If the participant was able to mand for the missing items of the activity in a different setting, then the behavior was considered setting generalization (Copper et al., 2007). A toy horse the same size as the miniature horse was selected as the new stimulus due to the research literature reported by Fine (2015) on studies conducted using toy and robotic animals in replacement of the real animal. By choosing to use a fake toy horse as the new stimulus it could be asessed if the findings turned out similar to those earlier studies (Fine, 2015).

Data Analysis

Visual Analysis

According to Barlow et al. (2009), visual analysis is the most common method to analyze the data for SCED. Typically, the data is displayed in line graphs to give the researcher the ability to discover trends and patterns from a participant's responses and drive decisions made regarding the intervention (Barlow et al., 2009; Cooper et al., 2007; Gast & Ledford, 2014). For

this study the number and types of manding responses and problematic behaviors were graphed for each participant using line graphs.

The ensuing components were used to analyze the line graphs for each participant and phase. The first step taken in the analysis of the data was to evaluate baseline for mean, level, trend, and variability to determine whether I had confidence in understanding the natural frequency of the behavior, to document anything concerning, and to use it to predict what future behavior would look like if we did not intervene (Kratochwill et al., 2010; WWC, 2017). The second step involved assessing and evaluating the intervention data for mean, level, trend, and variability to determine the natural frequency of the behavior under this condition (Kratochwill et al., 2010; WWC, 2017).

The third step took the information extracted from the previous steps and examined between-phase comparisons (i.e., looking at changes in mean level, variability, trend) as well as evaluating the immediacy of effect, overlapping data points, and consistency across similar phases (i.e., baselines across all cases and intervention phase across all cases) (Kratochwill et al., 2010; WWC, 2017). The final step of the visual analysis consisted of aggregating the data from each of the phase comparisons to determine whether the criteria had been met to establish a functional relation, which according to WWC (2017), three demonstrations of effect at different points of time is the minimum to achieve the meet with reservations standard.

The following are operational definitions provided by Kratochwill et al. (2010) and What Works Clearinghouse (2017) used in the visual analysis of this study:

- Mean Level is the mean score of the data within a phase.
- Trend refers to the overall slope of the data.

- Variability is the fluctuation of the data or standard deviation relative to the trend line.
- Immediacy of the effect is the rapidity of change between the last three data points of the previous phase and the first three data points in the subsequent phase for each participant.
- Consistency of data in similar phases refers to the similarity in the data patterns from phases with the same conditions.
- Overlap involves the ratio of data from one phase that overlaps with data from the preceding phase.

Effect Size

Effect sizes provide a quantitative estimate of the magnitude of an effect to be used to explain data to the public and compare it to related literature (Shadish et al., 2007). Effect sizes can be used to determine whether a confidence interval around the effect exists and to measure the strength of a relation between two variables on a numerical scale (Sullivan, & Feinn, 2012). This calculation can be used to evaluate consistency across studies with no conversion necessary, provide an estimated summary effect, and permit analysis of moderator variables that can affect outcomes (e.g., age, gender, intervention dose) (Carter, 2013). Several additional reasons have been cited by Parker and Hagan-Burke (2007) for reporting effect sizes for single-case studies, such as objectivity, precision, dependability, and general credibility.

For this study, Tau-U was selected as the effect size (Parker et al., 2011). Tau-U was selected because it has several strengths when compared to other non-overlap metrics: (a) considers all pairs of data, (b) ability to account for undesirable baseline trend, (c) ability to calculate confidence intervals (Parker & Hagan-Burke, 2009), and (d) evidence of

correspondence with visual analysis (Brossart et al., 2014). To calculate Tau-U for this study, a free online calculator was used (www.singlecaseresearch.org; Vannest et al., 2016).

For each participant baseline data was designated as Phase A and data collected during intervention was notated as Phase B. For each individual participant, Phase A and Phase B data were input into the calculator and the “correct baseline trend” option was selected to produce a Tau-U value for the AB phase contrast. Each AB phase contrast (i.e., one per participant) was aggregated to produce an overall Tau-U effect size for the study. When aggregating effect sizes, an inverse variance weighting scheme was applied. Therefore, the effect size for participants with more stable data were given more weight when identifying the overall effect size for the study (Brossart et al., 2018).

Between-case standardized mean difference (BC-SMD) was the second effect size method selected (Putejovsky et al., 2014). This effect size method was chosen to measure for magnitude of change and is comparable to group designs frequently reporting Cohen’s *d* effect size (Putejovsky et al., 2014). For this study the BC-SMD was calculated for only the main dependent variable, independent manding, using an online calculator (<https://jepusto.shinyapps.io/scdhlml/>; Putejovsky, 2016) The updated BC-SMD was used because the restricted maximum likelihood (REML) estimation method is available to use for calculation, allowing for greater flexibility (Putejovsky et al., 2014). The visual analysis results guided our decision on which options to choose. For both the baseline and intervention phases the level type of time trend was selected. This was the most simplistic model and provided the best fit with differential trends across most of the cases. Fixed and random effects were also specified for the level for both the baseline and intervention phases due to the level changes between the two phases also being differential across all cases (Putejovsky et al., 2014).

Validity and Reliability

Fidelity of Intervention

Fidelity of implementation of an intervention refers to ensuring the intervention was implemented as intended, which further support that a study's results can be attributed to the intervention (Barlow et al., 2009; Gast & Ledford, 2014). Horner et al. (2005) stated the importance of demonstrating fidelity of implementation of the independent variable when collecting data and recommended accomplishing this protocol by measuring the independent variable directly. Intervention fidelity was measured based on the delivery of the "Intervention Procedural Task Analysis" as shown in Appendix B via a fidelity checklist as exhibited in the Appendix D. The fidelity checklist listed all the instructional steps in relation to the intervention procedural task analysis steps, so the observer could score each correct instructional step applied accordingly. A graduate student outside the study with extensive knowledge in ABA and EAAT was recruited to be an observer and trained by the researcher via a video created to model all the steps and components of the intervention package. All sessions were video recorded, the observer viewed 30% of the recordings for each participant and answered each component of the fidelity checklist that was completed (number of steps marked/number of possible steps X 100). The fidelity training on the intervention was conducted concurrently with interobserver agreement (IOA) reliability training.

Interobserver Agreement Reliability (IOA). IOA is a method for increasing the reliability of the data by counteracting validity threats such as biases, which involves comparing independent observations from two or more participants of the same events. During the study, 30% of baseline and intervention phase data was observed for each participant. The type of IOA agreement procedure used for this study was Trial by Trial IOA, where the agreement between

two observers is measured either occurrence or nonoccurrence (number of trials agreement/total number of trials X 100), generally used with discrete trial data (Barlow et al., 2009; Cooper et al. 2007; Gast & Ledford, 2014). All sessions were videotaped to create a permanent product for coding via the primary (i.e., primary interventionist) and secondary coder. Both secondary coders for each dependent variable (manding type and problem behavior) were doctoral candidates in special education seeking certification as a Board-Certified Behavior Analysts. Before coding for IOA commenced, a four-hour training was provided. The IOA training for the manding type consisted of clarification of definitions for independent verbal manding behavior, prompting, and no response. The IOA training for the problem behavior involved detailed definitions of the topography of the problem behavior for each participant. Each observer used a separate data collection sheet for their respective dependent variable as shown in Appendix E and F for each participant and session. The IOA scores for this study met the WWC standards and are displayed in Table 1 and 2.

Chapter 4

Results

The purpose of this SCED study was to examine the effect an integrated intervention consisting of mand training with the EAL activity “dress the miniature horse” had on verbal manding behavior in children with ASD with limited verbal manding levels. This study used a single-case multiple baseline design across participants with ASD that had limited manding verbal behavior and occurred at a medical treatment center. The results from the SCED study suggested there was a functional relation between the implemented intervention and improved independent verbal manding behavior. In addition, the results also suggest the effects generalized to a novel setting and maintained several weeks after the intervention phase ended.

IOA for Dependent Variables

During the training phase for manding types IOA, the secondary coder was trained using five video sessions from the study, resulting in an overall 83% agreement using Trial by Trial IOA procedures, meeting the recommended 80% threshold (Barlow et al., 2009; Cooper et al. 2007; Gast & Ledford, 2014). The second coder for manding types then completed three additional sessions independently, resulting in an agreement of 94%. Subsequently, the remaining sessions were completed for IOA by the second coder. IOA was collected on 30% of baseline and 30% of intervention for manding behavior for each participant. Mean IOA for baseline was 92.2% (range = 66% – 100%) across participants and mean IOA for intervention was 96.4% (range = 66% – 100%) across participants. Disagreements were primary attributed to misinterpretation of the study’s operational definition for the types of mands. After clarifying this disagreement IOA was high throughout the rest of IOA sessions. See Table 1 for individual results at the participant level.

Table 1*Inter-Observer Agreement Results for Independent Manding*

Student	Baseline	Intervention	Overall
Student 1	100% range = 100-100%	100% range = 100-100%	100% range = 100-100%
Student 2	92% range = 83–100%	92% range = 66–100%	92% range = 66–100%
Student 3	94% range = 83-100%	96% range = 83-100%	95% range = 83-100%
Student 4	83% range = 66-100%	94% range = 83-100%	89% range = 66-100%
Student 5	92% range = 83-100%	100% range = 100-100%	96% range = 83-100%

During the training phase for IOA, the secondary coder for problem behavior was trained using three video sessions from the study, resulting in an overall 90.9% agreement using Trial by Trial IOA procedures, meeting the recommended 80% threshold (Barlow et al., 2009; Cooper et al. 2007; Gast & Ledford, 2014). The second coder for problem behavior then completed six additional sessions independently, resulting in an agreement of 82%. Both IOA coders also met at this time to review and clarify disagreements. IOA was collected on 30% of baseline and 30% of intervention for problem behavior for each participant. Mean IOA for baseline was 80.2% (range = 50% – 100%) across participants and mean IOA for intervention was 86.2% (range = 33% – 100%) across participants. Disagreements were primary attributed to misinterpretation of study definitions for the specific problem behaviors for each participant and possible observer drift. The original observer had the additional benefit of observing the behavior firsthand, which also could have contributed to IOA disagreements. See Table 2 for individual results at the participant level.

Table 2*Inter-Observer Agreement Results for Problem Behavior*

Student	Baseline	Intervention	Overall
Student 1	100% range = 100-100%	100% range = 100-100%	100% range = 100-100%
Student 2	67% range = 67-67%	100% range = 100-100%	86.8% range = 67-100%
Student 3	80% range = 60-100%	64.3% range = 33-100%	70.6% range = 33-100%
Student 4	71% range = 67-75%	66.7% range = 50-100%	68.4% range = 50-100%
Student 5	83.3% range = 50-100%	100% range = 100-100%	91.6% range = 50-100%

Fidelity of Implementation

Fidelity was collected for 30% of all intervention sessions for each participant via answering each component of the fidelity checklist that was completed (number of steps marked/number of possible steps X 100). The mean for fidelity of intervention was 89.8% (range = 76.2% – 100%) across participants. See Table 3 for individual results at the participant level.

Table 3*Fidelity Results*

Student	Intervention
Student 1	93.6% range = 85.7%-100%
Student 2	92% range = 85.7-95.2%
Student 3	80.9% range = 76.2-85.7%
Student 4	92% range = 85.7-95.2%
Student 5	90.4% range = 80.9-95.2%

Overall Results

This study included five participants diagnosed with ASD and limited manding behavior who were outpatients at a medical facility for children with disabilities. Overall, results from visual analysis suggested a functional relation was present between the mand training conducted in an EAL context with increase manding outcomes across all participants, refer to Figure 2 for graphed data. In addition to visual analysis, two effect sizes were calculated: (a) Tau-U and (b) the Between-Case Standardized Mean Difference (BC-SMD). The overall Tau-U was 96.5% (CI₉₅ [75.2%, 100%]), which indicates 96.5% of the intervention data were improved from a corrected baseline. The combined BC-SMD was 7.59 (CI₉₅ [5.20, 10.23]), meaning there is a 7.59 increase in standardized units from the baseline to intervention.

Visual Analysis

Verbal Manding

The results for the main dependent variable, which was defined earlier as a “type of manding verbal behavior,” was consistent across all five participants with increase in independent verbal mand behavior, as displayed in Figure 2. Throughout the baseline phase prompted verbal mands and no response were the norm with zero independent verbal manding for any of the items needed to complete the behavior task. Independent manding only began to occur once the intervention was implemented; across all participants independent mand behavior initially occurred by the second intervention session. All participants showed some upward trend during the intervention phase as well as a mean level increase between the two phases. In addition, all participants showed a positive immediacy mean difference for independent mand behavior. Only Participant Three never reach proficiency with six independent verbal mands. All

participants exhibited the same level of independent mand behavior with little variability during the maintenance and generalization probe.

Participant One. For Participant One the baseline mean level was at 0, since no independent mand behavior was observed during the baseline phase, which also meant there was no variability with zero trend. The intervention mean level was 4.9 for independent mands with an upward trend and considerable variability at the beginning of the intervention, but after several sessions it stabilized. For phase comparisons the visual analysis in Figure 2 shows significant mean level differences between the baseline at 0 and intervention phase at 4.9. It also displays a high level of immediate effect for independent mands with an immediacy mean difference of +3 as viewed in Table 4. Participant One achieved mastery (6 out of 6 mands) of independent mands by intervention session 4 and sustained with little variability to the maintenance and generalization probes. There was no overlap independent manding data for this participant.

Participant Two. Participant Two's baseline mean level, variability, and trend were the same as Participant One with zero independent mand behavior occurring. However, Participant Two had a higher mean level at 5.6 with less variability. There was also a slight upward trend during the intervention phase. Comparison between phases for Participant Two showed a higher mean level change with a baseline mean of 0 to an intervention mean level of 5.6. According to the interpretation from Table 4, Participant Two also had the highest immediacy effect with an immediacy mean difference of +5. Participant Two achieved mastery by the second session of the intervention and stabilized by the sixth session and continued to hold mastery level for the rest of the study with no variability. This participant also had no overlap independent manding data.

Participant Three. Participant Three also showed zero independent manding behavior during seven baseline sessions. This contributed to a baseline mean level of 0 with zero trend and no variability. During the intervention phase, Participant Three showed the lowest mean level at 1.6 with slight upward trend and high variability. Participant Three also had the least amount of change during phase comparison with a mean level of 0 to an intervention mean level of 1.6. Similarly, Participant Three had the smallest immediacy effect with an immediacy mean difference of +.67. While Participant Three did show a slight upward trend during intervention phase and four independent mands were observed by the end of the study, the participant never achieved mastery for six independent mands. There was only one data point at the second intervention session for independent manding out of 10 intervention sessions that overlapped with the baseline data.

Participant Four. Similar to the three previous participants, Participant Four also displayed zero independent manding behavior, which resulted in a mean level of 0 with no trend or variability. Participant Four had an intervention mean level of 4.1 with an upward trend and high variability for independent mand behavior. For the phase comparison Participant Four had similar results to Participants One and Two with a mean level change from 0 during baseline and 4.1 during the intervention phase. Participant Four had the second lowest immediacy effect with an immediacy mean difference of +1.3. However, Participant Four did reach mastery with six independent mand behaviors by intervention session 6 with medium variability and remained stable through the maintenance and generalization probes. This participant also only had one data point for independent manding out of 10 intervention sessions that overlapped with the baseline data, which was at the first intervention session.

Participant Five. Participant Five had the same baseline results for independent mand behavior as the other participants across 10 baseline sessions. Mean level during baseline for Participant Five was 0 with no trend or variability. The intervention mean level for Participant Five was comparable to most of the other participants at 4.2 with an upward trend and medium variability. The phase comparison for Participant Five was also similar to Participants One, Two and Four with a baseline mean level change of 0 to a 4.2 mean level change during intervention. The immediacy effect for Participant Five was comparable to the Participant One and Two with an immediacy mean difference of +3.33. Participant Five did reach mastery by the end of the intervention phase, however, did drop to 5 independent mands by the maintenance and generalization probes. There was no overlap independent manding data for this participant.

Table 4

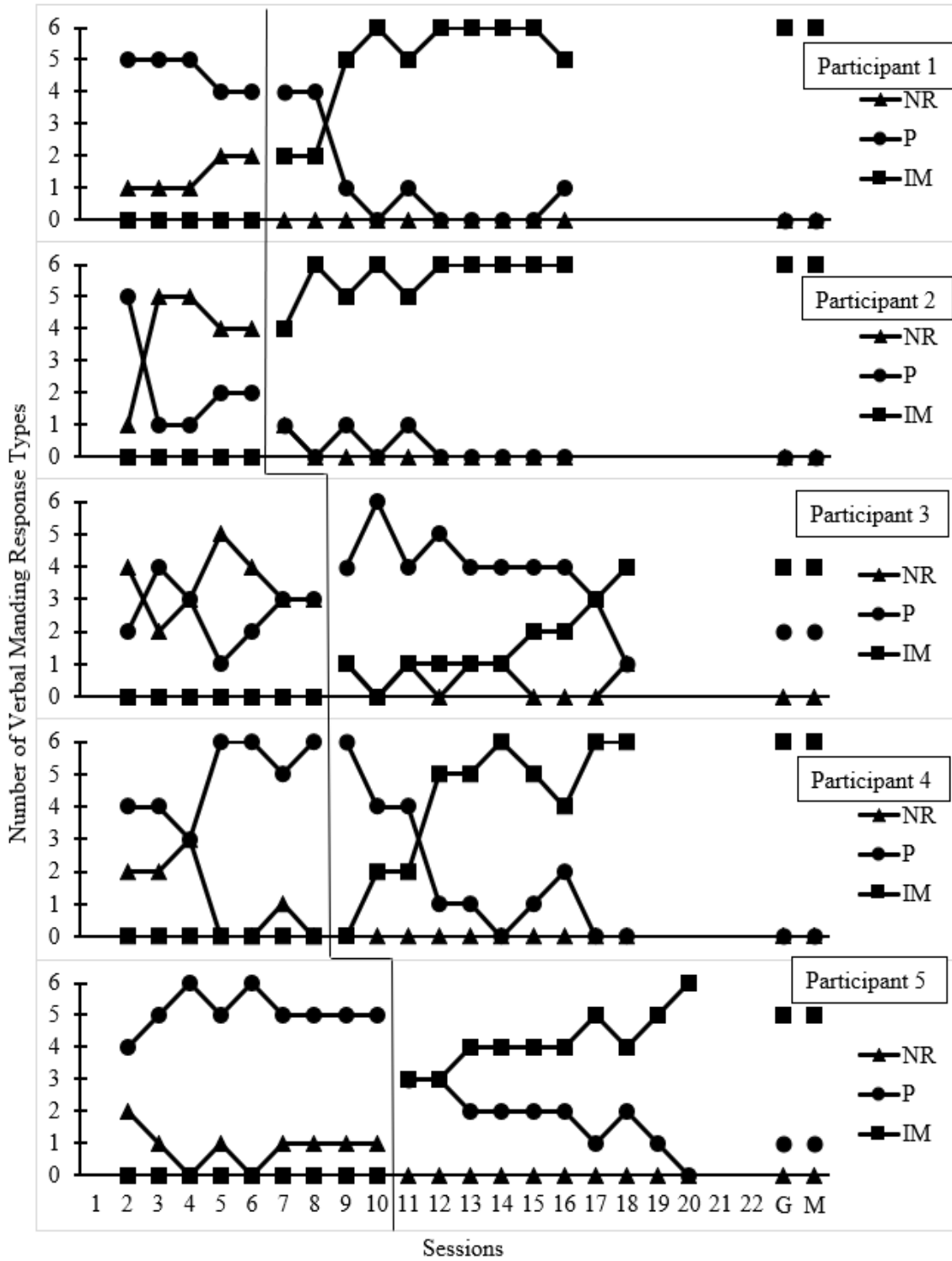
Immediacy of Effect Using Means

Participant	Independent Verbal Manding			Problem Behavior		
	Mean Last Three Baseline	Mean First Three Intervention	Mean Difference	Mean Last Three Baseline	Mean First Three Intervention	Mean Difference
P1	0	3	+3	0%	0%	0%
P2	0	5	+5	23%	0%	-23%
P3	0	.67	+.67	20%	8%	-12%
P4	0	1.3	+1.3	11%	0%	-11%
P5	0	3.33	+3.33	7%	0%	-7%

Note. P1 = Participant One; P2 = Participant Two; P3 = Participant Three; P4 = Participant Four; P5 = Participant Five.

Figure 2

Verbal Manding Type Results



Problem Behavior

The second dependent verbal was problem behavior, which was defined differently for each participant. Participants One and Two showed little to no problem behavior during the study while Participants Three, Four, and Five showed problem behavior during both baseline and intervention phases. The implementation of the intervention had a causal relationship with a slight decrease in problem behavior in those participants that problem behavior was first observed, due to the design of the study and collection of problem behavior data throughout all phases, as displayed in Figure 3. This problem behavior was reported in percentages as it was coded using partial intervals with 30-second increments over the full length of the session and for every session of this study.

Participant One. Participant One for the entire study never showed any problem behavior. The parents did report their child has showed problem behavior before in other settings and described in detail what kind of problem behavior to look for. However, for this study Participant One never showed a single problem behavior once during either the baseline or intervention phase.

Participant Two. Participant Two only showed problem behavior during the baseline phase, but once the intervention phase started the problem behavior consistently stayed at 0%. The baseline mean level for problem behavior was 23%, starting with an upward trend that then changed to a downward trend. The baseline problem behavior had medium variability and comparison between phases showed a lower mean level change with a baseline mean of 23% to an intervention mean level of 0%. Since there was no problem behavior recorded during the intervention phase, the mean level, trend, and variability were all 0. Participant Two, according to the interpretation of Table 4, had the highest immediacy effect with an immediacy mean

difference of -23%. From the visual analysis of Figure 3, there seemed to be very little overlap for problem behavior for Participant Two.

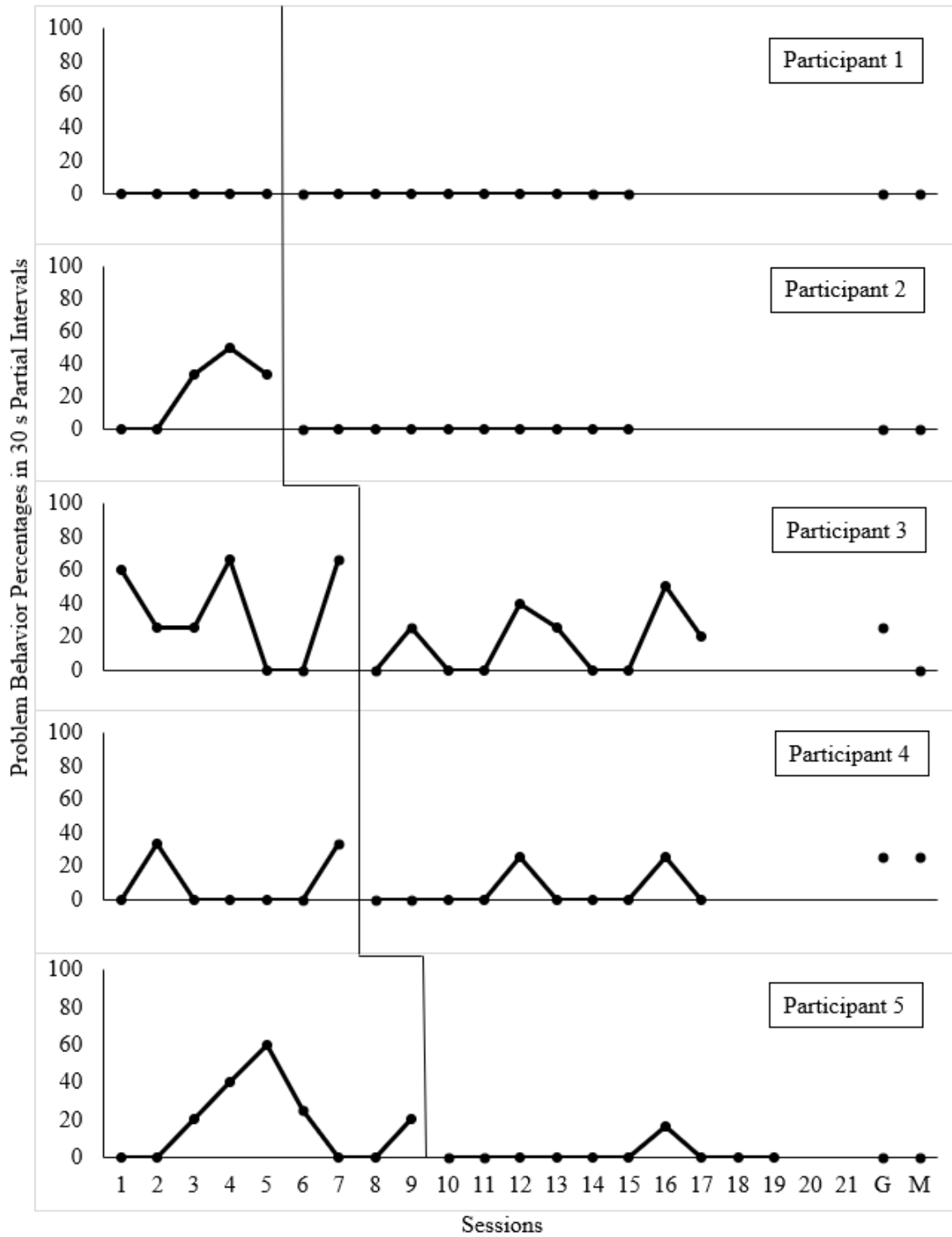
Participant Three. Problem behavior was observed most frequently for Participant Three, who also had the most variable data of all the participants. The baseline mean level was 35% with high variability and no trend. Once the intervention was implemented, the intervention mean level dropped to 16% with slightly less variability and no trend. This then showed in the comparison between phases an overall decrease of mean levels of 19%. The immediacy effect showed a mean level difference of -12% with considerable overlap between the two phases.

Participant Four. Participant Four baseline mean level for problem behavior was 9% with medium variability and no trend. The intervention phase mean level was 5% with medium variability and again no trend. The comparison between the two phases showed a slight overall drop of 3%. The immediacy effect showed a mean level difference of -11% with some overlap.

Participant Five. Participant Five also showed problem behavior during the entire study; the baseline mean level was 19% with high variability and no trend. The intervention phase mean level was 2% with high variability and again no trend. The comparison between the two phases showed an overall drop of 17%. The immediacy effect showed a mean level difference of -7% with some overlap.

Figure 3

Problem Behavior



Effect Size

Two effect sizes were calculated to measure the magnitude of effect between the independent variable package on the dependent variable on a statistical scale. The aggregated Tau-U was 96.5% (CI₉₅ [75.2%, 100%], which can be interpreted as 96.5% of the intervention data improved from the corrected baseline. The combined BC-SMD was 7.59 (CI₉₅ [5.20, 10.23]), indicating a 7.59 increase in standardized units from the baseline to intervention. The individual Tau-U values for each student and pair are displayed in Table 5 and the BC-SMD are shown in Table 6.

Table 5

Effects for Independent Manding.

Participant	Pairs	Tau-U	SD _{tau}	CI ₉₅ Lower	CI ₉₅ Upper	P value
P1	60	100%	31.6%	48%	100%	<0.01
P2	60	100%	31.6%	48%	100%	<0.01
P3	84	91.7%	28.2%	45.3%	100%	<0.01
P4	84	91.7%	28.2%	45.3%	100%	<0.01
P5	108	100%	26.1%	57.1%	100%	<0.01
Aggregate	396	96.5%	12.9%	75.2%	100%	<0.01

Note. SDTau = standard error of the estimated effect size; CI₉₅ = 95% Confidence Interval.

Table 6

Effects for Independent Manding using the Between-Case Standardized Mean Difference.

BC-SMD	Std Error	CI ₉₅ Lower	CI ₉₅ Upper	df	Auto	Baseline	Intervention
7.59	1.30	5.20	10.23	37.5	0.40	Level	Level & Linear
						F	F, R

Note. CI₉₅ = 95% Confidence Interval; *df* = Degrees of Freedom; Auto = Autocorrelation; F = Fixed Effect; R = Random Effect.

Field Notes

Over the duration of this research study there were some significant observations noted outside the data collection procedures. First, the parents of Participant One reported and showed the research team the visual weekly schedule they had created for the child, the schedule used a picture of the miniature horse as reminder of the reward the child could earn if they were good for the week. The parents reported this had decreased their child's problem behavior significantly at home and school. The parent for Participant Three reported that their child was terrified of dogs but showed excitement every time they came for a session to work with the miniature horse. The parent also noted her child's progression was faster with learning and remembering verbal words independently during the mand training and miniature horse compared to the two years of speech therapy her child had been receiving.

The family of Participant Four reported their child rarely expressed any emotion when interacting with his environment, however since starting the sessions with the miniature horse their child started expressing excitement every time, he came to the EAL environment. They also reported their child, who has never asked for a toy, saw a rocking horse at a garage sale and kept pointing at it and saying the miniature horses name. They then bought it for their child and when they brought the rocking horse home their child began working with the it in the same manner as he does with the miniature horse.

Social Validity

Teaching student's verbal communication skills has always had high social validity as these skills enable the individual to have more effective interaction with their current setting as well as open new doors to new environments and reinforcements (Cooper et al., 2007). All

participants responded positively to the intervention, according to the visual analysis. Each participant also demonstrated they could maintain their new levels of verbal manding skills and generalize them to a different stimulus, as displayed in Figure 2.

Further social validity data was gathered from the field notes and information gathered from speaking with the families of the participants. All participants when asked if they wanted to work with the miniature horses responded with a verbal “yes” and then would come within proximity of the horse to begin working on the behavioral task. The families of the participants also reported their children when asked if they wanted to go see the miniature horse responded with a verbal “yes” and/or grabbed their coat and headed to the car. When all the families were asked how this intervention compared to other therapy-like sessions their child has attended, all the responses were the same; their children did not perceive or react to working with the miniature horse the same as if they were going to a different type of therapy session. A majority of the parents said their child would cry, try to escape, or shut down when they would take their child to their other therapy sessions, however these behaviors did not occur when the child was taken to work with the miniature horse.

Summary of Findings

Overall, the visual analysis and the effect size results suggest a functional relation between the mand training conducted in an EAL context with the types of verbal manding outcomes across all participants. Across all participants an increase in independent verbal manding behavior was recorded by the end of the intervention phase. In addition, all participants were able to maintain their level of independent mands and generalize them to a new stimulus with little variability. Furthermore, from the field notes and social validity it was concluded the mand training in the EAL context became a reinforcer for each participant, as families would use

the intervention sessions (i.e., mand training with the miniature horse) as an activity they could access only if they showed appropriate behavior.

Chapter 5

Discussion

This dissertation study aimed to explore and investigate the impact of an integrated intervention that encompassed mand training with interruption procedures incorporated into an EAL therapy activity for children with ASD and their verbal manding behavior levels. The study also explored the intervention's impact on each participant's problem behavior levels during the baseline and intervention phases. In a recent systematic review Tan and Simmonds (2018) reported 15 of the 18 studies conducted using an EAAT intervention on participants with ASD found a functional relation between the EAAT intervention and the verbal behavior communication of the participants. Furthermore, studies by Albert et al. (2012), Lechago et al. (2010), and Sundberg et al. (2002) reported increased verbal manding behavior in all participants with ASD after they implemented a mand training with interruption procedure intervention. This study's intention was not only to investigate the impact of an integrated mand training and EAL activity but to also provide research in the literature gap between the two fields of study.

Interpretation of Findings

A summary of the findings from this study suggested a functional relation between the mand training and interruption procedures that were integrated in an EAL activity with the levels and types of verbal manding outcomes across all participants. Furthermore, an increase in independent manding across all participants was recorded once the intervention was implemented as well as a decrease in problem behavior in those participants that displayed problem behavior during the study. Despite the promising findings in respect to the intervention and independent manding levels, there were some concerning limitations which are discussed

further in the limitation section. The findings should be interpreted with caution in consideration of these limitations.

Research question 1. *Is there a functional relation between mand training with interrupted chain procedures integrated in an EAL activity and an increased mean level change of independent verbal manding behavior for students identified with ASD and limited manding behavior?*

The study revealed an increase in independent verbal manding behavior with a positive mean difference across all participants. The two effect sizes calculated for independent verbal manding behavior showed a high magnitude of change from baseline to intervention for all participants. Overall, from the study it can be summarized the integrated intervention (mand training with interruption procedures and an EAL activity) had a positive effect on all participants with ASD and limited manding behavior. The results of the study were consistent with Albert et al. (2012), Lechago et al. (2010), and Sundberg et al.'s (2002) results of a positive increase in independent mands across all participants with ASD. In relation to the EAAT research literature this study's results also aligned with the results from Holm et al. (2014) and Nelson et al. (2011) who showed significant improvement in verbalization when EAAT was implemented as an intervention for individuals with ASD.

Research question 2. *Is there a functional relation between mand training with interrupted chain procedures integrated into an EAL activity and a decrease mean level change of problem behavior for students identified with ASD and limited manding behavior?*

For those participants that displayed problem behavior at all during the study the mean difference was negative, showing a decrease in problem behavior when the intervention was implemented. There was one participant that never displayed any problem behavior during the

entire study. The findings of this study were consistent with the research conducted by Gutierrez et al. (2007) and Madzarova et al. (2012) who illustrated as manding repertoire skills increased for individuals with ASD, their problem behavior simultaneously decreased. This study's results also aligned with Gabriels et al. (2012), Holm et al. (2014), and Ward et al.'s (2013) findings of a decrease in problem behavior for those individuals with ASD who engaged in an EAAT intervention.

Research question 3. *Do effects maintain one-month post intervention (e.g., regression of one or less manding level)?*

The maintenance probe was collected for all participants at a minimum of three weeks or more post intervention phase. It appears the study's results are similar to that of Albert et al. (2012) with all participants maintaining their level of independent verbal manding behavior despite having a long break away from the intervention. Problem behavior results of this study also seemed to be similar to Ward et al.'s (2013) results of staying consistent across all participants during the maintenance probe.

Research question 4. *Do effects of mand training with interrupted chain procedures integrated into an EAL activity generalize to different conditions (i.e., new stimulus)?*

During the generalization probe a fake toy horse that was relatively the same size as the miniature horse was used instead of the real horse to complete the EAL activity. All participants appeared to generalize their level of independent manding behavior to the new stimulus (fake toy horse) with levels of independent verbal manding behavior staying stable to when the real horse was used during the intervention phase. The results of this study were consistent with Albert et al. (2012), Lechago et al. (2010), and Sundberg et al.'s (2002) findings for generalization when a new stimulus was introduced. This study's result also concurs with the results reported by Fine

(2015) and Melson et al.(2009) of children interacting with an animal substitute (e.g. toy robot) at the same level and in the same manner as the real live animal intervention. Problem behavior also seemed to stay stable for all participants during the generalization probe, which also was consistent with Gabriels et al. (2012) and Ward et al.'s (2013) findings for problem behavior during the generalization phase.

Implications

From a practical perspective single-case studies provide therapists and clinicians a simple method to investigate the impact and effectiveness of interventions as well as being sensitive to individuals' differences (Gast & Ledford, 2014; Kratochwill et al., 2010; Wong et al., 2015). The immediacy and continuous data collected and then further analyzed in a visual form is very meaningful to a practicing provider, giving them the ability to make changes to the intervention as needed (Barlow et al., 2009; Gast & Ledford, 2014; Kratochwill et al., 2010). Wong et al. (2015) stated a key implication for practitioners from studies, such as this one, is to employ both the knowledge generated from the study and the current research literature to better prepare a practitioner, who can then make better judgment decisions that will lead to more effective programs for students with ASD.

This study demonstrated the value of a single-case study by finding the integrated intervention (mand training with interruption procedures in an EAL activity) had a functional relation on positive outcomes with the types of manding levels in individuals with ASD as well as on problem behaviors. A practicing provider may find by implementing the same integrated intervention as in this study, in addition with careful control and manipulation of its variables, they may produce the same outcomes and benefits for their clients with ASD and limited verbal behavior. In combination with collecting qualitative data in the form of clinic notes to further

support their client's objective outcome measurements, they can make better decisions on implementing the most effective intervention that meets their client's needs. An additional note for practical purposes, there are some exclusive benefits of incorporating a miniature horse EAL program into ABA services, they include:

- The strong reinforcement value of the miniature horse
- The convenient mobility factor of the miniature horse (e.g. riding in van and coming to your clinic or school)
- The deeper-subconscious emotional connection with the horses versus an inanimate object (e.g. toy) (Fine, 2015).
- The prey (submissive-let you approach them and initiate contact) versus the predator (dominate-initiate approach and contact) (Fine, 2015).

For research purposes this study's findings aid in establishing research literature in the gap between the two existing interventions (mand training and EAL). Future research should investigate and try to replicate this study's findings across new participants as well as manipulate various variables within the context in either the form of different environments (e.g., classroom, home), different instructors, or different animals. Only by duplicating the results of this study while manipulating different variables and in a rigorous fashion can the integrated intervention progress from an alternative treatment to an evidence-based treatment, in a comparable fashion as what had transpired with HPOT (AHA, 2016; Cooper et al., 2007; Fine, 2015). Future research should also consider and identify any variables that could raise concern on validity or reliability of a research study. In the field of EAAT it is not the sheer number of publications that is lacking for scientific credibility but the dearth of methodological rigor that then led to questions on validity, generalizability, and replication of findings (Fine, 2015; Herzog, 2011).

Limitations

While this study did help contribute to the research literature between the two therapy fields (ABA and EAAT), it still had limitations to consider when interpreting findings. One of the limitations noted in this multiple baseline single-case study was the population sample. Originally during the recruitment period, inclusion criteria for participants included both inpatient and outpatient. Due to bureaucratic barriers and other unforeseeable issues, permission to include inpatient participants was never obtained for this study. This then caused another limitation concern with only using outpatient participants due to limiting the study's control over the other environmental factors' participants may have been exposed to because they were day clients and not residential. Another limitation was the issue of rescheduling sessions around families' and participants' availability. It is a concern that some of the effects, especially regarding problem behaviors, were influenced by moving the sessions from the weekend in the early afternoon to the middle of the week during the evening after school.

The lack of discriminating between prompt levels was another limitation to this study. Due to time constraints and limited resources only specific types of prompts were identified and coded for this study. However, to help lessen this limitation the difference between instructions and prompts as well as a spontaneous mand versus an independent mand was clarified by the research literature. IOA agreements on problem behavior for Participants Two, Three, and Four also caused some concern and limitations to this study. Despite multiple trainings to clarify disagreements, some of the IOA for problem behavior was less than satisfactory. This could have been due to either misinterpretations of the study's definition of problem behaviors for each participant, observer drift, or possible bias from one recorder who also observed the behaviors firsthand while the session was being video recorded.

Internal Validity

Threats to internal validity in this multiple baseline single-case study design included instrumentation, attrition, and reaction to controls. To counteract instrumentation threats all sessions were videotaped to create a permanent product that could then be scored later by multiple researchers for IOA. For attrition threats the study was kept as short as possible over a three-month span and successfully finished with five participants and only lost one due to attrition. To reduce the reaction to controls threat for this study systematic procedures for the intervention were put in place and adhered to, fidelity was conducted by an additional researcher, and fidelity percentages met the WWC standards (Kratochwill et al., 2010; What Works Clearinghouse, 2017).

External Validity

Threats to external validity for this study included reaction effects of experimental arrangements (due to the novelty of working with the miniature horse), interaction of time of measurement and treatment effects, and population validity. To neutralize the reaction effect of the experimental arrangements the study was conducted onsite at the medical facility that the participants were familiar with and received services prior to the study. For the interaction of time for measurement and treatment effects threat all sessions except two (due to parent schedule conflicts) were conducted the same day of the week and time over the three-month span of the study. To counteract the population validity threat for this study the population sample was identified and recruited within the constraints placed on the study to include as many diverse participants (i.e., gender, ethnicity, culture, socioeconomic, and family circumstances) from the targeted group.

Beyond the Study

Simultaneously, as data was collected for verbal manding behavior and problem behavior during each session so were field notes being collected from each observation and reports filed from each of the participants families. While the interpretation of these field notes is done with caution, there were some interesting findings that seemed worth reporting. There seemed to be several themes consistent across all participants. First, all families reported their child seemed to be more motivated and excited to participate in this intervention versus their typical behavior when going to a different type of therapy like speech. Parents indicated their children showed behavior of compliance by getting ready to go or a decrease in problem behavior like crying when shown a visual schedule with the intervention at the end of their schedule.

Another theme that was observed from the field notes was participants showed a deeper connection with the miniature horse than expected. This was observed in numerous ways. For example, one participant shocked their parents by asking for a toy rocking horse at a garage sale that was the same size as the miniature horse being used in the EAL activity. In fact, the participant independently manded for the rocking horse by pointing and repeating the miniature horse's name "Reba". The parents were excited by this new behavior (parents indicated he had never asked for a toy before) and bought the toy rocking horse for him; he then proceeded to interact with the rocking horse in the same manner as he did with the miniature horse via trying to dress it up as in the EAL activity. Another family reported their surprise in the level of attention their child gave the miniature horse after the session was over, wanting to pet and hug the horse or lead it around. They stated their child was usually indifferent to most animals (e.g., cats, fish, birds) and afraid of dogs, which she tended to avoid altogether. For another participant it was observed by the researcher and collaborated via the parent's reports of his complete reversal in attitude of indifference to the miniature horse in the EAL activity to expressing

compassion for the miniature horse by helping the EAL instructor care for the miniature horse's needs (e.g., bathroom breaks, treats) at the end of the study.

Conclusion: The Take Home Message

Fine (2015) claimed, "The horse is the 'therapist' first and foremost and is guided" (p.122), meaning guided "by the human therapist to meet the client's needs during the therapy session." This study wanted to investigate the impact of adding a miniature horse in the form of an EAL activity with evidence-based mand training techniques and measure the effect on manding types in participants with ASD. To help with this study's investigation a thorough systematic review of the literature was conducted and presented in the first few chapters. A solid methodology was selected that was sensitive to participants' individual behaviors and the highest standards were observed. The results from this study reported a positive impact on all participants' independent manding levels as well as on their problem behaviors. Interestingly, the field notes indicated some unintended positive effects of the miniature horse on the participants' behaviors and everyday quality of life (e.g., quicker word retainment, generalizing to rocking horse, initiating communication, and used as positive reinforcement for good behavior). However, the study did have some limitations that should be addressed in future replication studies or by similar research in the field. Lastly, despite these challenges, this study's findings contributed to the literature by filling a gap in research and, secondly, all participants showed improvements in all the targeted dependent variables. In the end, it was the testimonies of the parents and families that really said it all. So many expressed their delight in their children's progress and asked if more services like this would be available in the near future.

References

- Ajzenman, H., Standeven, J., & Shurtleff, T. (2013). Effect of hippotherapy on motor control, adaptive behaviors, and participation in children with autism spectrum disorder: A pilot study. *The American Journal of Occupational Therapy: Official Publication of the American Occupational Therapy Association*, 67, 653-63.
- Albert, K., Carbone, M., Murray, V., Hagerty, J., & Sweeney-Kerwin, D. (2012). Increasing the mand repertoire of children with autism through the use of an interrupted chain procedure. *Behavior Analysis in Practice*, 5, 65-76.
- American Hippotherapy Association. (2016). *Aha, Inc. hippotherapy*.
<https://www.americanhippotherapyassociation.org/>
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. American Psychiatric Pub.
- American Psychiatric Association. (2018). *Autism spectrum disorder*.
<https://www.psychiatry.org/patients-families/autism/what-is-autism-spectrum-disorder>
- Baer, D., Wolf, M., & Risley, T. (1968). Some current dimensions of applied behavior analysis 1. *Journal of Applied Behavior Analysis*, 1(1), 91-97.
- Baio J., Wiggins L., Christensen D., Maenner, M., Daniels, J., Warren, Z., Kurzius-Spencer, M., Zahorodny, W., Rosenberg, C. R., White, T., Durkin, M., Imm, P., Nikolaou, L., Yeargin-Allsopp, M., Lee, L-C., Harrington, R., Lopez, M., Fitzgerald, R., Hewitt, A., Pettygrove, S., Constantino, J., Vehorn, A., Shenouda, J., Hall-Lande, J., Van Naarden Braun, K., & Dowling, N. (2018). Prevalence of autism spectrum disorder among children aged 8 years — Autism and developmental disabilities monitoring network, 11

- Sites, United States, 2014. *Morbidity and Mortality Weekly Report*, 67, 1–23.
<http://dx.doi.org/10.15585/mmwr.ss6706a1>
- Barlow, D. H., Nock, M. K., & Hersen, M. (2009). *Single case experimental designs: Strategies for studying behavior change* (3rd ed.). Pearson Education, Inc.
- Beck, A. M., & Katcher, A. H. (2003). Future directions in human-animal bond research. *American Behavioral Scientist*, 47(1), 79-93.
- Behavior Analyst Certification Board. (2020). *Behavior analyst certification board*.
<https://www.bacb.com/about-behavior-analysis/>
- Betz, A. M., Higbee, T. S., & Pollard, J. S. (2010). Promoting generalization of mands for information used by young children with autism. *Research in Autism Spectrum Disorders*, 4, 501-508.
- Borgi, M., Loliva, D., Cerino, S., Chiarotti, F., Venerosi, A., Bramini, M., Nonnis, E., Marcelli, M., Vinti, C., De Santis, C., Bisacco, F., Fagerlie, M., Frascarelli, M., & Cirulli, F. (2016). Effectiveness of a standardized equine-assisted therapy program for children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 46(1), 1-9.
- Boyd, K. J. (2013). The language of equus: Exploring equine-assisted psychotherapy (EAP) using the equine assisted growth and learning association (EAGALA) model (Publication No. 587)[Master's Thesis, Smith College]. Smith ScholarWorks.
<https://scholarworks.smith.edu/theses/587>
- Brossart, D., Laird, V., & Armstrong, T. (2018). Interpreting kendall's tau and tau-u for single-case experimental designs. *Cogent Psychology*, 5(1), 1-26.
- Brossart, D. F., Vannest, K. J., Davis, J. L., & Patience, M. A. (2014). Incorporating nonoverlap indices with visual analysis for quantifying intervention effectiveness in single-case

experimental designs. *Neuropsychological Rehabilitation*, 24, 464–491.

<https://doi.org/10.1080/09602011.2013.868361>

Carnett, A., Waddington, H., Hansen, S., Bravo, A., Sigafos, J., & Lang, R. (2017). Teaching mands to children with autism spectrum disorder using behavior chain interruption strategies: A systematic review. *Advances in Neurodevelopmental Disorders*, 1, 1-18. 10.1007/s41252-017-0038-0.

Carter, M. (2013). Reconsidering overlap-based measures for quantitative synthesis of single-subject data: What they tell us and what they don't. *Behavior Modification*, 37, 378–390. <https://doi.org/10.1177/0145445513476609>

Catania, C. (2017). *The ABCs of applied behavior analysis: An introduction to behavior and learning*. GlassFrogBooks.

Centers for Disease Control and Prevention. (2019). *Autism spectrum disorder (ASD): Data and statistics*. <https://www.cdc.gov/ncbddd/autism/data.html>

Certified Horsemanship Association. (2017). *Certified horsemanship association*. <http://cha-hse.org/store/>

Christ, T. (2007). Experimental control and threats to internal validity of concurrent and nonconcurrent multiple baseline designs. *Psychology in the Schools*, 44, 451-459.

Colombi, C., Narzisi, A., Ruta, L., Cigala, V., Gagliano, A., Pioggia, G., Siracusano, R., Rogers, S., & Muratori, F. (2018). Implementation of the early start Denver model in an Italian community. *Autism*, 22, 126-133.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis* (2nd ed.). Pearson.

- Deochand, N., & Fuqua, R. W. (2016). BACB Certification Trends: State of the States (1999 to 2014). *Behavior Analysis in Practice*, 9, 243-252. doi: 10.1007/s40617-016-0118-z
- DePauw, K. P. (1986). Horseback riding for individuals with disabilities: Programs, philosophy, and research. *Adapted Physical Activity*, 3, 217-226.
- Dewkett, M. N., Brady, H. A., & Hernandez, H. M. (2016). *The comprehensive guide to equine-assisted activities and therapies*. Indianapolis, IN: Dog Ear Publishing.
- EAGALA. (2010). *Welcome*. <https://www.eagala.org/index>
- Fine, A. H. (2015). *Handbook on animal-assisted therapy: Theoretical foundations and guidelines for practice* (3rd ed.). Elsevier Academic Press.
- Gabriels, R. L., Agnew, J. A., Holt, K. D., Shoffner, A., Zhaoxing, P., Ruzzano, S., Clayton, G., & Mesibov, G. (2012). Pilot study measuring the effects of therapeutic horseback riding on school-age children and adolescents with autism spectrum disorders. *Research in Autism Spectrum Disorders*, 6, 578-588.
- Gabriels, R. L., Pan, Z., Dechant, B., Agnew, J. A., Brim, N., & Mesibov, G. (2015). Randomized controlled trial of therapeutic horseback riding in children and adolescents with autism spectrum disorder. *Journal of the American Academy of Child & Adolescent Psychiatry*, 54, 541-549.
- Gabriels, R., Pan, Z., Guérin, N., Dechant, B., & Mesibov, G. (2018). Long-term effect of therapeutic horseback riding in youth with autism spectrum disorder: A randomized trial. *Frontiers in Veterinary Science*, 5, 1-8.
- Gambrill, E. (2013). Birds of a feather: Applied behavior analysis and quality of life. *Research on Social Work Practice*, 23, 121-140.

- Gast, D. L., & Ledford, J. R. (2014). *Single subject research methodology: Applications in Special Education and Behavioral Sciences* (2nd ed.). Routledge.
- Granados, A. C., & Agis, I. F. (2011). Why children with special needs feel better with hippotherapy sessions: A conceptual review. *Journal of Alternative and Complementary Medicine, 17*(3), 191-197. <http://dx.doi.org/10.1089/acm.2009.0229>
- Gutierrez, A., Vollmer, T. R., Dozier, D. L., Borrero, J. C., Rapp, J. T., & Bourret, J. C., (2007). Manipulating establishing operations to verify and stimulus control during mand training. *Journal of Applied Behavior Analysis, 40*, 645–658.
- Haggerty, H. (2014). *How equine assisted therapy can improve the quality of life for individuals diagnosed with autism, ages 2-18* (Doctoral dissertation, College of Brockport). <https://digitalcommons.brockport.edu/cgi/viewcontent.cgi?article=1039&context=spectrum>
- Herzog, H. (2011). The impact of pets on human health and psychological well-being: Fact, fiction, or hypothesis? *Current Directions in Psychological Science, 20*, 236-239.
- Holm, M., Baird, B., Kim, J., Rajora, M., D'Silva, Y., Podolinsky, J., Mazefsky, C., & Minshew, D. (2014). Therapeutic horseback riding outcomes of parent-identified goals for children with autism spectrum disorder: An ABA multiple case design examining dosing and generalization to the home and community. *Journal of Autism and Developmental Disorders, 44*, 937-947.
- Horner, R. H., Carr, E. G., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional Children, 71*, 165-179

- Horner, R. H., Swaminathan, H., Sugai, G., & Smolkowski, K. (2012). Considerations for the systematic analysis and use of single-case research. *Education and Treatment of Children, 35*, 269-290.
- IAN. (2011). IAN Research Findings: Animal-Assisted Therapies.
https://iancommunity.org/cs/ian_treatment_reports/animal_assisted_therapies
- Individuals with Disabilities Education Act, 20 U.S.C. § 1400 (2004).
- Isaacson, R. (2009). *The horse boy*. Little Brown Company.
- Jennett, H., Harris, S., & Delmolino, L. (2008). Discrete trial instruction vs. mand training for teaching children with autism to make requests. *The Analysis of Verbal Behavior, 24*, 69-85.
- Johnson, J. M., & Pennypacker, H. S. (2009). *Strategies and tactics for human behavioral research* (3rd ed.). Erlbaum.
- Kanne, S. M., Gerber, A. J., Quirnbach, L. M., Sparrow, S.S., Cicchetti, D. V., & Saulnier, C. A. (2011). The role of adaptive behavior in autism spectrum disorders: Implications for functional outcomes. *Journal of Autism and Developmental Disorders, 41*, 1007-1018.
<https://doi.org/10.1007/s10803-010-1126-4>
- Karol, J. (2007). Applying a traditional individual psychotherapy model to equine-facilitated psychotherapy (EFP): Theory and method. *Clinical Child Psychology and Psychiatry, 12*(1), 77-90. <https://doi.org/10.1177/1359104507071057>
- Klontz, B. T., Bivens, A., Leinart, D., & Klontz, T. (2007). The effectiveness of equine-assisted experimental therapy: Results of an open clinic trial. *Society and Animals, 15*, 257-267.
<https://doi.org/10.1163/156853007X217195>
- Kratochwill, T. R., Hitchcock, J., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M., &

- Shadish, W. R. (2010). *Single-case designs technical documentation*.
http://ies.ed.gov/ncee/wwc/pdf/wwc_scd.pdf
- Lamarre, J., & Holland, J. G. (1985). The functional independence of mands and tacts. *Journal of the Experimental Analysis of Behavior*, *43*(1), 5-19.
- Larsson, E. V. (2013). Is applied behavior analysis (ABA) and early intensive behavioral intervention (EIBI) an effective treatment for autism? A cumulative history of impartial independent reviews. *The Lovaas Institute for Early Intervention Midwest Headquarters*, 1–14. <https://behavior.org/wp-content/uploads/2017/06/649.pdf>
- Leblanc, L., Heinicke, M., & Baker, J. C. (2012). Expanding the consumer base for behavior-analytic services: Meeting the needs of consumers in the 21st century. *Behavior Analysis in Practice*, *5*, 4-14. 10.1007/BF03391813.
- Lechago, S., Carr, J., Grow, L., Love, J., & Almason, S. (2010). Mands for information generalize across establishing operations. *Journal of Applied Behavior Analysis*, *43*, 381-395.
- Madzharova, M. S., Sturmey, P., & Jones, E. A. (2012), Training staff to increase manding in students with autism: Two preliminary case studies. *Behavioral Interventions*, *27*, 224-235. doi:10.1002/bin.1349
- Mapes, A. R., & Rosén, L. A. (2016). Equine-assisted therapy for children with autism spectrum disorder: A comprehensive literature review. *Review Journal of Autism and Developmental Disorders*, *3*, 377-386.
- Marion, C., Martin, G., Yu, C. T., & Buhler, C. (2011). Teaching children with autism spectrum disorder to mand "What is it?" *Research in Autism Spectrum Disorders*, *5*, 1584-1597.
<https://doi.org/10.1016/j.rasd.2011.03.005>

- Marino, L., & Lilienseld, S. O. (2007). Dolphin-assisted therapy: More flawed data and more flawed conclusions. *Anthrozoos, 20*, 239-249.
- Masini, A. (2010). Equine-assisted psychotherapy in clinical practice. *Journal of Psychosocial Nursing and Mental Health Services, 48*, 30-34. [10.3928/02793695-20100831-08](https://doi.org/10.3928/02793695-20100831-08)
- McDaniel Peters. B., & Wood, C. (2017). Autism and equine-assisted interventions: A systematic mapping review. *Journal of Autism and Developmental Disorders, 47*, 3220-3242.
- Melson, G. F., Kahn, Jr., P. H., Beck, A., Friedman, B., Roberts, T., Garrett, E., & Gill, B. T. (2009). Children's behavior toward and understanding of robotic and living dogs. *Journal of Applied Developmental Psychology, 30*, 92-102.
- Miller, J. S., Bilder, D., Farley, M., Coon, H., Pinborough-Zimmerman, J., Jenson, W., Rice, C., Fombonne, E., Pingree, C. B., Ritvo, E., Ritvo, R. A., & McMahon, W. M. (2013). Autism spectrum disorder reclassified: A second look at the 1980s Utah/UCLA autism epidemiologic study. *Journal of Autism and Developmental Disorders, 43*(1), 200–210. <http://doi.org/10.1007/s10803-012-1566-0>
- Mody, M., & Belliveau, J. W. (2013). Speech and language impairments in autism: Insights from behavior and neuroimaging. *North American Journal of Medicine & Science, 5*, 157–161.
- National Center for Education Statistics (2019). *Children and youth with disabilities*. https://nces.ed.gov/programs/coe/indicator_cgg.asp
- National Institute of Mental Health. (2018). *Autism spectrum disorder*. <https://www.nimh.nih.gov/health/topics/autism-spectrum-disorders-asd/index.shtml>
- National Research Council. (2001). *Educating children with autism*. National Academy Press.

- Nelson, K., Axtell, J., Derby, K. M., Moug, R., Berrera, S., & McLaughlin, T. (2011). A preliminary analysis of therapeutic horseback riding. *International Journal of Social Sciences and Education, 1*(4), 644–656.
- Newschaffer, C. J., Croen, L. A., Daniels, J., Giarelli, E., Grether, J. K., Levy, S. E., Mandell, D., Miller, L., Pinto-Martin, J., Reaven, J., Reynolds, A., Rice, C., Schendel, D., & Windham, G. C. (2007). The epidemiology of autism spectrum disorders. *Annual Review of Public Health, 28*, 235-58.
- O’Haire, M. E. (2013). Animal-assisted intervention for autism spectrum disorder: A systematic literature review. *Journal of Autism and Developmental Disorders, 43*, 1606-1622.
- O’Haire, M. E., McKenzie, S. J., Beck, A. M., & Slaughter, V. (2013). Social behaviors increase in children with autism in the presence of animals compared to toys. *PLoS ONE, 8*, e57010.
- O.K. Corral Series. (2013). *O.K. corral series*. <http://okcorralseries.com/>
- Parker, R. I., & Hagan-Burke, S. (2007). Useful effect size interpretations for single case research. *Behavior Therapy, 38*, 95–105. <https://doi.org/10.1016/j.beth.2006.05.002>
- Parker, R. I., Vannest, K. J., Davis, J. L., & Sauber, S. B. (2011). Combining nonoverlap and trend for single-case research: Tau-U. *Behavior Therapy, 42*, 284–299. <https://doi.org/10.1016/j.beth.2010.08.006>
- Professional Association of Therapeutic Horsemanship International. (2018). *PATH international*. <https://www.pathintl.org/>
- Pellecchia, M., & Himeline, P. N. (2007). Generalization of mands in children with autism from adults to peers. *The Behavior Analyst Today, 8*, 483-491. <http://dx.doi.org/10.1037/h0100634>

- Plavnick, J., & Ferreri, S. (2011). Establishing verbal repertoires in children with autism using function-based video modeling. *Journal of Applied Behavior Analysis, 44*, 747-66.
- Putejovsky, J. E. (2016). Scdhlm: A web-based calculator for between-case standardized mean differences (Version 0.3.1) [Web application]. <https://jepusto.shinyapps.io/scdhlm/>
- Putejovsky, J. E., Hedges, L. V., & Shadish, W. R. (2014). Design-comparable effect size in multiple baseline designs: A general modeling framework. *Journal of Educational and Behavioral Statistics, 39*, 368-393.
- Rigby, B., & Grandjean, P. (2016). The efficacy of equine-assisted activities and therapies on improving physical function. *Journal of Alternative and Complementary Medicine, 22*(1), 9-24.
- Rogers, S. J. (2004). Developmental regression in autism spectrum disorders. *Mental Retardation and Developmental Disabilities Research Reviews, 10*, 139-143.
- Sautter, R., & Leblanc, L. (2006). Empirical applications of skinner's analysis of verbal behavior with humans. *The Analysis of Verbal Behavior, 22*, 35-48.
- Schreibman, L., Stahmer, A. C., Barlett, V. C., & Dufek, S. (2009). Brief report: Toward refinement of a predictive behavioral profile for treatment outcome in children with autism. *Research in Autism Spectrum Disorders, 3*(1), 163-172.
- Shadish, W., Rindskopf, D. M., Julnes, G., & Rog, D. J. (2007). Methods for evidence-based practice: Quantitative synthesis of single-subject designs. *New Directions for Evaluation, 2007*(113), 95-109.
- Sidman, M. (1960). *Tactics of scientific research*. Basic Books.
- Skinner, B. F. (1938). *The behavior of organisms; An experimental analysis*. New York, London: D. Appleton-Century Company, incorporated.

- Skinner, B. F. (1957). *Verbal behavior*. Copley Publishing Group.
- Smith, I. M. (2004). *Motor problems in children with autistic spectrum disorder*. In D. Dewey & D. E. Tupper (Eds.), *Developmental motor disorder: A neuropsychological perspective* (pp. 152–168). The Guilford Press.
- Smith-Osborne, A., & Selby, A. (2010). Implications of the literature on equine-assisted activities for use as a complementary intervention in social work practice with children and adolescents. *Child & Adolescent Social Work Journal, 27*, 291-307.
<https://doi.org/10.1007/s10560-010-0201-1>
- Snider, L., Korner-Bitensky, N., Kammann, C., Warner, S., & Saleh, M. (2007). Horseback riding therapy for children with cerebral palsy: Is there evidence of its effectiveness? *Physical & Occupational Therapy in Pediatrics, 27*, 5-23.
- Souter, M. A., & Miller, M. D. (2007). Do animal-assisted activities effectively treat depression? A meta-analysis. *Anthrozoos, 20*, 167-180.
- Spink, J. (1993). *Development riding therapy: A team approach to assessment and treatment*. Therapy Skill Builders.
- Srinivasan, S. M., Cavagnino, D. T., & Bhat, A. N. (2018). Effects of equine therapy on individuals with autism spectrum disorder: A systematic review. *Review Journal of Autism and Developmental Disorders, 5*, 156-175.
- Steiner, H., & Kertesz, Z. (2015). Effects of therapeutic horse riding on gait cycle parameters and some aspects of behavior of children with autism. *Acta Physiologica Hungarica, 102*, 324-335.

- Still, K., May, R. J., Rehfeldt, R. A., Whelan, R., & Dymond, S. (2015). Facilitating derived requesting skills with a touchscreen tablet computer for children with autism spectrum disorder. *Research in Autism Spectrum Disorders, 19*, 44-58.
- Stock, R., Mirenda, P., & Smith, I. M. (2013). Comparison of community-based verbal behavior and pivotal response treatment programs for young children with autism spectrum disorder. *Research in Autism Spectrum Disorders, 7*, 1168-1181.
- Sullivan, G. M., & Feinn, R. (2012). Using effect size-or why the p value is not enough. *Journal of Graduate Medical Education, 4*(3), 279-82.
- Sundberg, M. L. (2008) *VB-MAPP verbal behavior milestones assessment and placement program: A language and social skills assessment program for children with autism or other developmental disabilities: Guide*. AVB Press.
- Sundberg, M., Loeb, M., Hale, L., & Eigenheer, P. (2002). Contriving establishing operations to teach mands for information. *The Analysis of Verbal Behavior, 18*, 15-29.
- Sundberg, M., & Michael, J. (2001). The benefits of skinner's analysis of verbal behavior for children with autism. *Behavior Modification, 25*, 698-724.
- Sweeney-Kerwin, E. J., Carbone, V. J., O'Brien, L., Zecchin, G., & Janecky, M. N. (2007). Transferring control of the mand to the motivating operation in children with autism. *The Analysis of Verbal Behavior, 23*(1), 89–102. <https://doi.org/10.1007/bf03393049>
- Tager-Flusberg, H., & Kasari, C. (2013). Minimally verbal school-aged children with autism spectrum disorder: The neglected end of the spectrum. *Autism Research, 6*, 468-478.
- Tan, V. X. L., & Simmonds, J. G. (2018). Equine-assisted interventions for psychosocial functioning in children and adolescents with autism spectrum disorder: A literature

- review. *Review Journal of Autism and Developmental Disorders*.
<https://doi.org/10.1007/s40489-018-0143-7>
- Tawney, J., & Gast, D. (1984). *Single subject research in special education*. Charles E. Merrill.
- U.S. Department of Education. (2017). *39th annual report to congress on the implementation of the individuals with disabilities education act office of special education and rehabilitative services*. Office of Special Education Programs.
- Vannest K. J., Parker, R. I., Gonen, O., & Adiguzel, T. (2016). *Single case research: Web based calculators for SCR analysis* (Version 2.0) [Web-based application]. Texas A&M University. <http://www.singlecaseresearch.org/calculators>
- Verschuur, R., Huskens, B., Verhoeven, L., & Didden, R. (2017). Increasing opportunities for question-asking in school-aged children with autism spectrum disorder: Effectiveness of staff training in pivotal response treatment. *Journal of Autism and Developmental Disorders*, 47, 490-505.
- Voos, A., Pelphrey, K., Tirrell, J., Bolling, D., Vander Wyk, B., Kaiser, M., McPartland, J., Volkmar, F., & Ventola, P. (2013). Neural mechanisms of improvements in social motivation after pivotal response treatment: Two case studies. *Journal of Autism and Developmental Disorders*, 43(1), 1-10. <https://doi.org/10.1007/s10803-012-1683-9>
- Ward, S.C., Whalon, K., Rusnak, K., Wendell, K., & Paschall, N. (2013). The association between therapeutic horseback riding and the social communication and sensory reactions with autism. *Journal of Autism and Developmental Disorders*, 43, 2190-2198.
<http://dx.doi.org/10.1007/s10803-013-1773-3>
- Watson, J. B. (1913). Psychology as the behaviorist views it. *Psychological Review*, 20, 158-177.

Westling, D. L., Fox, L., & Carter, E. W. (2015). *Teaching students with severe disabilities* (5th ed.). Pearson.

What is Verbal Behavior? (n.d.). Retrieved April 27, 2020, from

<https://www.aba2learn.com/about-aba/what-is-verbal-behavior/>

What Works Clearinghouse (2017). *WWC procedures and standards handbook* (Version 4.0). Institute of Education Sciences. <https://ies.ed.gov/ncee/wwc/Handbooks>

Wilson, E. (1984). *Biophilia*. Harvard University Press.

Winborn, L., Wacker, D. P., Richman, D. M., Asmus, J., & Geier, D. (2002). Assessment of mand selection for functional communication training packages. *Journal of Applied Behavior Analysis, 35*, 295–298.

Wong, C., Odom, S., Hume, L., Cox, K., Fettig, A., Kucharczyk, A., . . . Schultz, M. (2015). Evidence-based practices for children, youth, and young adults with autism spectrum disorder: A comprehensive review. *Journal of Autism and Developmental Disorders, 45*, 1951-1966. doi: 10.1007/s10803-014-2351-z

Wuang, Y., Wang, C., Huang, M., & Su, C. (2010). The effectiveness of simulated developmental horse-riding program in children with autism. *Adapted Physical Activity Quarterly: APAQ, 27*, 113-126.

Yorke, J., Adams, C., & Coady, N. (2008). Therapeutic value of equine-human bonding in recovery from trauma. *Anthrozoos, 21*, 17-30.

<https://doi.org/10.2752/089279308X274038>

Yorke, J., Nugent, W., Strand, E., Bolen R., New, J., & Davis, C. (2013). Equine-assisted therapy and its impact on cortisol levels of children and horses: A pilot study and meta-

analysis. *Early Child Development and Care*, 183, 874-894.

<https://doi.org/10.1080/03004430.2012.693486>

APPENDIX A

Baseline Procedural Task Analysis

Step	Description
1	Have miniature horse and EAAT therapist prepared to start EAL activity in the designated therapy room.
2	Bring participant close to the materials needed to begin the EAL activity of dress-up your pony.
3	Give verbal instructions of either “dress horse”, “what’s next?”, and/or “what goes here?”
4	Allow items to complete the behavior task be within sight but not within reach in order to require manding behavior to gain access to the item.
5	If the correct targeted vocal mand topography is given, then reinforce the behavior by giving the physical item requested and with praise immediately after the request.
6	If participant emits any response other than the targeted vocal mand topography or with no response at all within the latency period, then provide a verbal prompt for the item in view. If the participant echoes the vocal prompt, then immediately reinforce the behavior by giving the requested item.
7	Continue to repeat steps 3-6 for the next item (i.e., bow, beads, blanket) in the behavior chain until the EAL activity is complete.

APPENDIX B

Intervention Procedural Task Analysis

Step	Description
1	Have miniature horse and EAAT therapist prepared to start EAL activity in the designated therapy room.
2	Bring participant close to the materials needed to begin the EAL activity of dress-up your pony.
3	Give verbal instructions of either “dress horse”, “what’s next?”, and/or “what goes here?”
4	Take the required items to complete the behavioral chain out of sight (place in box).
5	Pause (10s) to give participant a chance to respond independently. If the correct targeted vocal mand topography is given, then reinforce the behavior by giving the physical item requested and with praise immediately after the request.
6	If participant emits any response other than the targeted vocal mand topography or with no response at all within the latency period, then provide a verbal prompt for the item in view. If the participant echoes the vocal prompt, then immediately reinforce the behavior by giving the requested item.
7	Continue to repeat steps 3-6 for the next item (i.e., bow, beads, blanket) in the behavior chain until the EAL activity is complete.

APPENDIX C

EAL Activity “Dress the Horse”

1. Mand for **brush** to brush horse
2. Mand for head**band** for hair on horse’s forehead
3. Mand for a **bow** to put on horse
4. Mand for the horse’s **dress** accessory
5. Mand for the horse’s **crown** accessory to place on head
6. Mand for **beads** to put around the horse’s neck

Note. Materials removed to teach mands are in **boldface**.

Example of “dress horse” activity



APPENDIX D

Fidelity Scoring Sheet

Directions:

- Notate Participant and Session Number at the top of the table.
- Please mark with an **X** for each intervention procedural step that was followed correctly as stated in the Intervention Procedural Task Analysis, this includes all repeated steps until the EAL session ends.

Participant: _____ Session: _____

1 _____ Have miniature horse and EAAT therapist prepared to start EAL activity in the designated therapy room.

2 _____ Bring participant close to the materials needed to begin the EAL activity of dress-up your pony.

3 _____ Give verbal instruction of “dress horse.”

Manding for Item 1 (Brush)

4 _____ Takes the first required item to complete the behavioral chain out of sight.

5 _____ Pauses to give the participant a chance to respond independently.

Choose one:

6 _____ the correct targeted vocal mand topography is given then reinforce the behavior by giving the physical item requested and with praise immediately after the request.

or

6 _____ the participant emits any response other than the targeted vocal mand topography or with no response at all within the latency period, a verbal prompt for the missing item is provided.

_____ the participant echoes the vocal prompt, then immediately reinforced the behavior with the missing item.

Manding for Item 2 (Band)

7 _____ Takes the first required item to complete the behavioral chain out of sight.

8 _____ Pauses to give the participant a chance to respond independently.

Choose one:

9 _____ the correct targeted vocal mand topography is given then reinforce the behavior by giving the physical item requested and with praise within 2s of the request.

or

9 _____ the participant emits any response other than the targeted vocal mand topography or with no response at all within the latency period, a verbal prompt for the missing item is provided.

_____ the participant echoes the vocal prompt, then immediately reinforced the behavior with the missing item.

Manding for Item 3 (Crown)

10_____ Takes the first required item to complete the behavioral chain out of sight.

11_____ Pauses to give the participant a chance to respond independently.

Choose one:

12_____ the correct targeted vocal mand topography is given then reinforce the behavior by giving the physical item requested and with praise immediately after of the request.

or

12_____ the participant emits any response other than the targeted vocal mand topography or with no response at all within the latency period, a verbal prompt for the missing item is provided.

_____ the participant echoes the vocal prompt, then immediately reinforced the behavior with the missing item.

Manding for Item 4 (Bow)

13_____ Takes the first required item to complete the behavioral chain out of sight.

14_____ Pauses (10s) to give the participant a chance to respond independently.

Choose one:

15_____ the correct targeted vocal mand topography is given then reinforced the behavior by giving the physical item requested and with praise immediately after the request.

or

15_____ the participant emits any other response other than the targeted vocal mand topography. or with no response at all within the latency period, a verbal prompt for the missing item is provided.

_____ the participant echoes the vocal prompt, then immediately reinforced the behavior with the missing item.

Manding for Item 5 (Beads)

16_____ Takes the first required item to complete the behavioral chain out of sight.

17_____ Pauses (10s) to give the participant a chance to respond independently.

Choose one:

17_____ the correct targeted vocal mand topography is given then reinforced the behavior by giving the physical item requested and with praise immediately after the request.

or

_____ the participant emits any response other than the targeted vocal mand topography or with no response at all within the latency period, a verbal prompt for the missing item is provided.

_____ the participant echoes the vocal prompt, then immediately reinforced the behavior with the missing item.

Manding for Item 6 (Blanket)

18_____ Takes the first required item to complete the behavioral chain out of sight.

19_____ Pauses (10s) to give the participant a chance to respond independently.

Choose one:

20_____ the correct targeted vocal mand topography is given then reinforced the behavior by giving the physical item requested and with praise immediately after the request.

or

21_____ the participant emits any response other than the targeted vocal mand topography or with no response at all within the latency period, a verbal prompt for the missing item is provided.

_____ the participant echoes the vocal prompt, then immediately reinforced the behavior with the missing item.

Observer Notes: Below, record any discrepancies, problems or issues that occurred during your observation (could include disruption from parent or sibling or horse has an accident etc.)

APPENDIX E
IOA Manding Scoring Sheet

Directions:

- First, notate participant number, the session number (do not use Session 1, M, or G) and then circle **(B)** for baseline or **(I)** for intervention.
- Second, watch video and record each participants manding responses during the EAL activity using the **coding key** listed on the Behavior Chain for the EAL Activity “Dress the Horse” (Appendix C).
- Abbreviations: **IM**=Independent Mand, **P**=Prompted, and **NR**= No Response

Participant Number: _____			B or I	Session Number: _____	
Mand 1	Mand 2	Mand 3	Mand 4	Mand 5	Mand 6

Participant Number: _____			B or I	Session Number: _____	
Mand 1	Mand 2	Mand 3	Mand 4	Mand 5	Mand 6

Participant Number: _____			B or I	Session Number: _____	
Mand 1	Mand 2	Mand 3	Mand 4	Mand 5	Mand 6

Participant Number: _____			B or I	Session Number: _____	
Mand 1	Mand 2	Mand 3	Mand 4	Mand 5	Mand 6

Participant Number: _____			B or I	Session Number: _____	
Mand 1	Mand 2	Mand 3	Mand 4	Mand 5	Mand 6

Participant Number: _____			B or I	Session Number: _____	
Mand 1	Mand 2	Mand 3	Mand 4	Mand 5	Mand 6

APPENDIX F
IOA Problem Behavior Scoring Sheet

Problem Behavior Defined for each Participant:

Participant 1(P1) = Tantrum-like behavior to include hurting himself (i.e., biting, hitting himself, falling to the floor).

Participant 2 (P2) = Non-Compliant/Refusal behavior for this participant looks like a brief or low-intensity failure to respond to instructor (i.e., not following directions, refusal to complete task correctly, ignoring request of instructor to ask and instead grabbing item).

Participant 3(P3) = Non-Compliant/Refusal behavior for this participant looks like a brief or low-intensity failure to respond to instructor (i.e., not following directions, ignoring request of the instructor, playing or putting items on herself).

Participant 4 (P4) = Elopement behavior for this participant was leaving designated work area (fenced in area around horse) (i.e., opening gate of fenced area and leaving works space, walking away from task playing with curtains).

Participant 5 (P5) = Elopement behavior for this participant was leaving designated work area (fenced in area around horse) (i.e., opening gate of fenced area and leaving works space, walking away from task, playing with curtains).

Directions: If a participant at any time during the 30 sec interval displays their defined problem behavior mark Y for YES in the interval session box or N for No if no problem behavior occurs during the interval session.

Participant Number: _____					Baseline or Intervention							
Session	Start time	30 sec	30 sec	30 sec	30 sec	30 sec	30 sec	30 sec	End Time	Intervals Occurred	Total Intervals	%

Participant Number: _____					Baseline or Intervention							
Session	Start time	30 sec	30 sec	30 sec	30 sec	30 sec	30 sec	30 sec	End Time	Intervals Occurred	Total Intervals	%

Participant Number: _____					Baseline or Intervention							
Session	Start time	30 sec	30 sec	30 sec	30 sec	30 sec	30 sec	30 sec	End Time	Intervals Occurred	Total Intervals	%

Participant Number: _____					Baseline or Intervention							
Session	Start time	30 sec	30 sec	30 sec	30 sec	30 sec	30 sec	30 sec	End Time	Intervals Occurred	Total Intervals	%

APPENDIX G

ABA and EAAT Studies Showing Outcomes on Communication Behaviors on Subjects with ASD

Authors	Type	Design	Sample	Setting	Measure	Admin	IV	DV	Findings
Holm et al., 2014	EAAT /TR	SCED: Multiple Baseline n=3	Children with ASD	TF	Aberrant Behavior Checklist community (ABC-C)	TR therapist	Doses of TR	Problem Behaviors & Communication skills	Increased verbalization, increased compliance of directives; Improved physical strength and coordination
Borgi et al., 2016	EAAT /TR	Randomized controlled trial n=28	Children with ASD	TF	Pre-Post test	TR therapists	TR vs Control Group	Social behavior including communication	Increased social motivation and language skills; increase in their ability to interact socially
Gabriels et al., 2012	EAAT /TR	Quasi-experimental n=42	Children with ASD	TF	Pre-Post test	TR therapist	TR vs Control Group	Self-regulation, adaptive living skills, and expressive language skills	Significant improvement on self-regulation behaviors and expressive language skills
Ajzenman et al., 2013	EAAT /HPO T	Quasi-experimental n=6	Children with ASD	TF	Pre-Post test	TR therapist	An HPOT treatment	Adaptative behaviors to include communication	Significant improvement in communication, coping, daily activity and social participation

Gabriels et al., 2015	EAAT /TR	Randomized controlled trial n=116	Children with ASD	TF	Pre-Post test	TR therapists	TR vs Control Group	Self-regulation, socialization, communication, adaptive behavior, motor skills	Significant improvement on experimental group compared to control in irritability, hyperactivity, social communication, total words spoken, number of new words spoken
Gabriels et al., 2018	EAAT /TR	Randomized controlled trial n=116; follow up on 2015 study	Children with ASD	TF	Pre-Post test	TR therapists	TR vs Control Group	Follow-up on self-regulation, socialization, communication, adaptive behavior, motor skills	Sustained significant initial improvements in social and communication behaviors, number of words, & different words spoken
Ward et al., 2013	EAAT /TR	Quasi-experimental: Single group n=21	Children with ASD	TF	Pre-Post test	TR therapists	TR with interrupted treatment	Social communication & Sensory processing skills	Significant improvement in social communication, attention, tolerance, and reactions to sensory input
Nelson et al., 2011	EAAT /TR	SCED: ABAB Reversal n=3	Children with ASD	TF	Observations of operationally defined behaviors	TR therapists	TR	Imitation verbal responses or sounds, verbal mands, & spontaneous verbal responses or mands	Increased verbalization and communication behavior

Steiner & Kertesz, 2015	EAAT /TR	Randomized group comparison n=26	Children with ASD	TF	Pre-Post test	TR therapists	TR vs Control Group	Communication, gross & fine motor skills, self-care and interpersonal interaction	Significant gains in communication, motor skills, self-care, and interpersonal interactions
Harris & Williams, 2017	EAAT /TR	Quasi-experimental n=26	Children with ASD	TF	Pre-Post test	TR therapists	TR vs Control Group	Social communication, engagement, stereotype behavior, & hyperactivity	Increases in social communication & engagement; no significant change in stereotype behavior or hyperactivity
Madzharova, Sturmey, & Jones, 2012	ABA	SCED: AB n=6	Children with ASD	ABA-based school for children with ASD	Observed behavior correctly completing TA steps & independent mands	Teacher & TAs	Behavior skill training package	Percentage of correct steps each staff member completed within each teaching trial & the number of independent mands	Increased number of independent manding behavior
Colombi et al., 2018	ABA	Quasi-experimental treatment study n=22	Children	Clinic	Pre-post tests	Treatment Teams	ESDM vs Control Group	Cognitive function, communication, adaptive and social skills	Demonstrated significant gains in cognitive function, communication, adaptive and social skills
Voos et al., 2013	ABA	Quasi-experimental treatment study n=2	Children	Clinic & Home setting	Pre-posttests with behavioral coding	licensed Psychologist with several trained	PRT vs Control Group	Social communication, adaptive behavior, eye tracking & neutral stimuli	Increased instances of initiating request and questions, on-topic comments; adaptive skills; eye tracking

Schreibman et al., 2009	ABA	SCED: Multiple Baseline n=6	Children	Clinic	Coded contingent communication; Collected trial-by-trial data on task completion	Therapists	PRT & DTT	Language, play & social behavior	results were highly variable Gains in both spontaneous and cued vocalization; significant reductions in core ASD symptom severity
Verschuur et al., 2017	ABA	SCED: Multiple Baseline n=3 groups	Children /Staff	Inpatient treatment facility	Event-recording and interval-recording system	Therapists and trained PRT staff members	PRT	Staff-created opportunities and child-initiated questions	Significant increases in both staff-created opportunities and child-initiated questions.
Stock, Miranda, & Smith, 2013	ABA	Quasi-experimental pre-test/post-test design with matched groups n=14	Children	Private group ABA pre school program	Pre-post tests	Therapists & teaching staff	PRT & Community-based verbal behavior	Cognitive, receptive, expressive language, adaptive behavior skills, and problem behavior	Results for both groups showed statistically significant changes in cognitive scores, receptive and expressive language age equivalents, and problem behavior scores. No significant change adaptive behavior

Marion et al., 2011	ABA	SCED: Multiple Baseline n=3	Children	Participant's homes	Observed behavior coding	Therapists	ABA: created program	Manding verbal behavior	Results were positive; participants learned to mand correctly, manding behavior increased and generalized to the natural environment
Jennett et al., 2008	ABA	SCED: Concurrent Multiple Probe	Children	Developmental Disabilities Center,	Observed frequency and behavior coding	Therapists/researcher	Discrete Trial vs Manding Training	Spontaneous manding and trials to master of manding behavior	Increases for spontaneous manding was found for both methods; Mand training showed faster mastery of manding behavior than Discrete Trial.
Plavnick & Ferreri, 2011	ABA	SCED: alternating treatments design n=4	Children	School/classroom	Observed frequency and behavior coding	Researcher	Function based and nonfunction-based video modeling	Manding verbal/gestural behavior	Results demonstrated that function-based video modeling is more effective in teaching and increasing manding behavior
Still et al., 2015	ABA	SCED: Multiple Baseline n=3	Children	School/classroom	Observed frequency of manding behavior and number of trials	Researcher	ABA: Intervention touchscreen tablet	Spontaneous manding and trials to master of manding behavior	Results were positive; participants learned to mand to matching prompt, spontaneous manding behavior increased

Note. IV = independent variable, DV = dependent variable, EAAT = equine-assisted activities and therapy, TR = therapy riding, TF = therapy facility, ASD = autism spectrum disorder, ABA = applied behavior analysis, SCED = single case experimental design, EDSM = Early Start Denver Model, PRT = Pivotal Response Treatment, DTT = Discrete Trial Training.

APPENDIX H

Therapy Name	Description
Equine-Assisted Activities/Therapies (EAAT)	Umbrella term for all therapy with horses.
Therapeutic Riding (TR) -Also called Equine-Assisted Activities (EAA)	Perform activities like riding, horsemanship and barn management skills.
Equine-Assisted Learning/Therapy (EAL^a/EAT) Similar only the therapy version is recommended by a medical professional	Accomplish rehabilitative goals for the patient (i.e., participant interact with horse to improve focus, boundaries, and personal growth).
Equine-Assisted/Facilitated Psychotherapy (EAP/EFP)	Achieved through a licensed mental health professional, who uses the horse's social and behavioral herd aspects to facilitate improvement in patient's mental health.
Hippotherapy (HPOT)	Completed by a licensed physical, occupational, or speech-language pathologist who is also licensed as a HPCS and utilizes the medical benefits of the horse's natural walking rhythm (often prescribed).
Therapeutic Carriage Driving (TCD)^b	Adapted for those participants that are unable to ride and instead interact with a horse through driving.
Therapeutic Vaulting (TV)^b	Learn and perform precise strategic moments on and around the horse to build core and motor function skills.

Note.^a EAL is the version of EAAT that will be combined with ABA as an intervention package.

^b These are versions of EAAT that were mentioned in textbooks, but not utilized in any of the research studies utilized for the literature review.

APPENDIX I

EAAAT Organizations	Description
American Hippotherapy Association (AHA)	Program dedicated to the licensing of Hippotherapy Clinical Specialists (HPCS) and the use of horse therapy in conjunction with physical, occupational, or speech therapy professional.
North American Riding for the Handicapped Association (NARHA)- Now known as PATH	Program founded in 1969; British model for their own association practices.
Professional Association of Therapeutic Horsemanship International (PATH Intl.)	Program originally was NARHA, but name changed in 2011; offered therapeutic disciplines of both mounted and unmounted activities with the horse, giving facilities the freedom to match needs of their participants.
Equine Assisted Growth and Learning Association (EAGALA)	Program's focus is the mental health aspects from equine therapy.
Certified Horsemanship Association (CHA)	Program strictly designed for riding therapy, however not just those with disabilities; they include mainstream.
O.K. Corral Series	Program evolved from one of the founders of EAGALA. Program is also similar as it too is only designed for mental health through equine therapy.