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The effects of tact training for students diagnosed with Autism: Will stimulus equivalence be demonstrated through the acquisition of intraverbal responses?

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The Effects of Tact Training for Students Diagnosed with Autism: Will Stimulus
Equivalence be Demonstrated through the Acquisition of Intraverbal Responses?

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Abstract

While there have been numerous studies on the effects of tact training, there is a limited amount of research on the effects of tact training on the emergence of intraverbal responses. The purpose of this study was to examine the effects of tact training on the acquisitions of intraverbals demonstrated through stimulus equivalence for students who have a diagnosis of autism spectrum disorder (ASD). The research attempted to answer the following questions: Was tact training an effective procedure to increase a student's verbal repertoire; did tact training of both nouns and verbs increase emergence of noun-verb intraverbal combinations; did tacting of nouns, verbs, and noun-verb combinations generalize into the classroom with the teacher, and; did teacher(s) and/or paraprofessional(s) view the procedures acceptable and useful within the classroom? Two students with a diagnosis of autism were taught unknown nouns and verbs through tact training. Participants were taught both nouns and verbs using a constant time delay prompting procedure. Researcher examined the emergence of intraverbal responses demonstrated through stimulus equivalence. Probe trials were used to determine the effects of the intervention on the emergence of intraverbal responses demonstrated through stimulus equivalence.

The Effects of Tact Training for Students Diagnosed with Autism: Will Stimulus Equivalence be Demonstrated through the Acquisition of Intraverbal Responses

Introduction

Autism Spectrum Disorder and Language

The prevalence of individuals diagnosed and placed on the autism spectrum is considerably higher than it has been in the past, with current prevalence being 1 in 68 individuals in the United States diagnosed with autism spectrum disorder (ASD; Christensen et al., 2016; Zablotsky, Black, Maenner, Schieve & Blumberg, 2015). ASD, as defined by the Center for Disease Control and Prevention (CDC; 2017) is a developmental disability that can cause significant challenges in several areas including social, communication and behavioral. Children with ASD, as defined by *The Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM-5; American Psychiatric Association, 2013) have persistent deficits in social communication and social interaction across multiple contexts and restricted, repetitive patterns of behavior, interest or activities. The degree of the deficit in language for an individual with ASD may vary; however, there are trends or similarities in the language limitations of individuals with ASD (Greer & Ross, 2004).

In addition to the medical definition provided by the DSM-5, the Individuals with Disability Education Act (IDEA) elaborates that definition to the field of education:

Autism means a developmental disability significantly affecting verbal and nonverbal communication and social interaction, generally evident before age three, that adversely affects a child's educational performance. Other characteristics often associated with autism are engagement in repetitive activities

and stereotyped movements, resistance to environmental change or change in daily routines, and unusual responses to sensory experiences. A child who manifests the characteristics of autism after age three could be identified as having autism if the aforementioned criteria are satisfied. Autism does not apply if a child's educational performance is adversely affected primarily because the child has an emotional disturbance (IDEA, 2017).

The Virginia Department of Education (VDOE, 2017) has created an autism worksheet to assist the eligibility team in assessing if a student who is being considered for services under an autism diagnosis meets the eligibility criteria. The worksheet has several true/false questions to assist in determining eligibility for services under an autism diagnosis. The worksheet lists the following questions: a) does the child display characteristics of autism; b) is the child's education performance adversely affected primarily because the child has an emotional disturbance; c) is there documentation available of an adverse effect on educational performance due to one or more characteristics of autism; and d) due to the identified autism, does the student need individualized instruction? An individualized education program (IEP) team must meet and answer true for all of the questions listed above for a student to be eligible to receive services under an autism eligibility in the state of Virginia.

A Board-Certified Behavior Analyst (BCBA) work is guided by evidence-based practices and interventions. BCBAs practice applied behavior analysis (ABA) allowing them to implement a wide variety of interventions. These interventions are especially beneficial for individuals with ASD due to the fact that children with ASD not only are at

risk for delayed language development, but also for atypical language development when compared to their typically developing peers (Luyster, Lopez & Lord, 2007).

Behavior analysis is a science broken into two categories which are experimental behavior analysis and applied behavior analysis (ABA; Johnson, Kohler & Ross, 2017). ABA can be defined as a science whose main purpose is to understand and improve human behavior (Cooper, Heron & Heward, 2007). This science has expanded into the field of special education, and specifically with individuals with ASD. Within that field is a subfield which is verbal behavior analysis (Greer & Ross, 2008). Language can be viewed the same as any other behavior, meaning that language can be shaped and reinforced like all other behavior (Barbera, Rasmussen & Sundberg, 2007). This allows a behavior analyst to create and implement plans to create change in language through ABA interventions.

Verbal Behavior

Verbal behavior analysis focuses on the effect of both the speaker on the behavior of the listener and vice versa, rather than focusing on language structures alone (Greer, 2008; Sunberg & Michael, 2001). Verbal behavior analysis, in combination with basic ABA principles, teaches students with ASD skills related to language (Barbera et al., 2007). Verbal behavior was initially introduced by B.F. Skinner in his book *Verbal Behavior* in 1957. Skinner (1957) describes verbal behavior by pointing out its emphasis on the individual speaker and whether it is recognized by the user or not, specifically behavior shaped and maintained by mediated consequences. This concept was named verbal behavior because Skinner wanted to introduce a term that was new and did not have a history in literature (Ingvarsson, 2016). Greer and Ross (2008) elaborated on

Skinner's definition of verbal behavior by saying verbal behavior is a behavior that is based on reinforcement that is mediated by another person, concerned with the function of language. In other words, the effect that a speaker has on a listener is derived from the science of behavior and from its applications.

Skinner (1957) defined several verbal operants, which are the concepts that allow verbal behavior to be categorized according to several characteristics that include antecedents and consequences. Those verbal operants include behavioral descriptions of behaviors previously called requesting, labeling, conversations, adjectives, adverbs and even writing (Johnson et al., 2017). Those behavioral descriptions can be discussed using the following terms:

1. Mand: a child requesting an item.
2. Echoic: a child imitating a vocal model.
3. Intraverbal: a child verbally responds to a question or statement.
4. Tact: a child labeling an item
5. Autoclitic: a child uses an adjective or adverb to request or label an item.

Speaker and Listener Behavior

In verbal behavior both the speaker and the listener play an important role; however, both the speaker and the listener have concise roles. The behavior of the speaker will only be considered verbal if what is said is reinforced by the listener (Ingvarsson, 2016). Any behavior that is under the control of the speaker, needing reinforcement of the behavior will be considered listener behavior (Ingvarsson, 2016). Listener behavior, as mentioned above must be reinforced, without reinforcement the behavior is unlikely to be maintained (Ingvarsson, 2016).

Skinner's work in his book *Verbal Behavior* impacted the growth of language assessments for children with ASD (Partington & Sundberg, 1998; Sundberg, 2008). The primary language assessments used by BCBA's are; *The Assessment of Basic Language and Learning Skills-Revised* (ABLSS-R) and the *Verbal Behavior Milestones Assessment and Placement Program* (VB-MAPP; Partington & Sundberg, 1998; Sundberg, 2008). Verbal Behavior (VB) approaches can be very complicated and it is often beneficial and/or necessary to have a BCBA with VB training and knowledge to be a coach for the staff, update programming and to revise the plan at hand based on the child's progress (Barbera et al, 2007).

Tacts and Tact Training or Instruction

The term tact is derived from the word contact, implying one's contact with the environment (Greer & Ross, 2008). Skinner (1957) defined tact as "a verbal operant in which a response of a given form is evoked by a particular object or event or property of an object or event." When referring to tacts, the nonverbal stimulus that they are controlled by should be a stimulus such as an object or action (Ingvarsson, 2016). The action of tacting can also be extended to characteristics of objects such as color and shape, categories, emotions and even private events (Ingvarsson, 2016). Tacts are said to be a controlled stimulus, therefore it is important to provide the environment for tacts to occur under appropriate stimulus control (Ingvarsson, 2016). To elaborate on the basic definition of tact, Ross & Greer, (2008) define tact as "See-say responses. Verbal operants under the control of a prior controlling stimulus. Can be of many different response topographies, and are reinforced by generalized reinforcers such as attention or confirmation" (p. 4).

It has been noted that tacts become more prominent in typical verbal development because they are able to provide a basic foundation for complex verbal repertoires (Ross & Greer, 2008). There are instances when students do not acquire tacts or tacting behaviors on their own; if tacts are not acquired within a given time period, alternative procedures are used to build tact repertoires (Johnson et al., 2017). It has been noted that a large number of children will need tact training or instruction prior to learning how to name (Ross & Greer, 2008). Tact training is important because students who are able to tact likely demonstrate an increase in verbal behavior and spontaneous speech (Ross & Greer, 2008). Tacts and the ability to tact are essential to an individual's functional language and a basis for responses on Intelligence Quotients (IQ) tests (Ross & Greer, 2008).

Intraverbals

Ross & Greer (2008) define intraverbals as a “verbal responses that are controlled by a verbal antecedent as in greeting; the two responses do not have point-point correspondence with one another” (p. 8).

Intraverbal responses are similar to tact responses because intraverbals are maintained by reinforcement in the form of attention, social interaction and/or conversation (Ingvarsson, 2016). Intraverbals are broken down into three capabilities, which are important when assessing intraverbal development (Ross & Greer, 2008):

1. Engaging in self-talk, a fundamental part of speaker-as-own-listener.
2. Intraverbal discourse with others, an important component of socialization.
3. Perspective-taking which involves I, you, my, your, here, then, there, now, etc.

Children who are typically developing and have enriched language experiences tend to acquire these capabilities independently. However, if any of these capabilities are missing, then they must be taught (Ross & Greer, 2008). As mentioned above, intraverbals are a part of our social language, therefore intraverbals strongly influence our social relationships and reasoning (Diaz & Gonzalez, 2015). In contrast, intraverbals vary from tacts because they are brought on by stimuli that are in the verbal form (Ingvarsson, 2016). With intraverbals being a large part of our social language and social language being important for building relationships, it is important that we are able to make connections that are not explicitly explained (Greer & Ross, 2008). Stimulus equivalence is one possible way for us to make those connections.

Stimulus Equivalence

Cooper et al. (2007) defines stimulus equivalence as “the emergence of accurate responding to untrained and nonreinforced stimulus-stimulus relations following the reinforcement of responses to some stimulus-stimulus relations” (p. 705).

Sidman (1971) originally discussed the concept of stimulus equivalence and since the original discussion, stimulus equivalence has been used to evaluate the relationships among stimuli. Equivalence relationships can be broken down into three properties; reflexivity, symmetry, and transitivity. Reflexivity is understanding that A is equal to A, symmetry is understanding that if A is equal to B, then B is equal to A, and transitivity is understanding that A is equal to B and A is equal to C, then B is equal to C (Leblanc, Miguel, Cummings, Goldsmith & Carr, 2003). While all of the relations were not specifically taught, some of the relations emerge as a result of the prior training. The

different components of this class are described as equivalent because they can be interchanged for any of the other components within the class.

The original study Sidman (1971) conducted on stimulus equivalence was used to teach an individual with developmental disabilities equivalent relations. The individual was taught equivalent relations between pictures, dictated words, and printed words. The conclusion of that study permitted there to be a progression and increase in the skills that can be taught using stimulus equivalence to individuals with and without disabilities. Math, spelling, and second languages are among the skills that can be taught using stimulus equivalence.

Stimuli with little to no relation have the ability to enter into the same stimulus classes through stimulus equivalence training (Sidman & Tailby, 1982). While there is ample information on stimulus equivalence in general, there is a limited amount of research using stimulus equivalence with children who have been diagnosed with a disability. Cautilli, Hancock, Thomas, & Tillman (2002) state that stimulus equivalence training for children with an intellectual disability has not been properly studied or integrated into early intervention curricula for children with autism.

Purpose of the Study

The purpose of this study is to examine the effects of tact training to produce intraverbals via stimulus equivalence when working with students with ASD. The study will answer the following questions:

1. Is tact training an effective procedure to increase a student's verbal repertoire?
2. Can tact training of both nouns and verbs increase emergence of noun-verb intraverbal combinations?

3. Can tacting of nouns, verbs, and noun-verb combinations be generalized in the classroom with a teacher?
4. Do teacher(s) and/or paraprofessional(s) view the procedures acceptable and useful within the classroom?

Review of Literature

This chapter includes an overview of the following specific topics; (1) verbal behavior, (2) tacts and tact training, (3) listener responding, and (4) stimulus equivalence. In addition to a review of literature there is also a list of key terms and their definitions for clarification.

Verbal Behavior

This section describes the impact that verbal behavior instruction has had on individuals with autism and other disabilities. There is an abundance of literature on verbal behavior, however articles that encompassed all components of verbal behavior were limited. Therefore, the literature reviewed in this section is made up of literature further explaining the research done on the components of verbal behavior and its importance.

Cruvinel and Hubner (2013) conducted a study to investigate the acquisition of verbal behavior in typically developing children between the ages of 17 months and 2 years, adopting categories based on the verbal operants proposed by Skinner (1957). The sessions were conducted in what was described as a natural environment, which was usually the participant's home. The research shows that cumulative frequency of mand, tact, echoic, and intraverbal categories emitted increased gradually and concurrently until the approximate age of 20 months. In addition, the research found that caregivers emitted more mands than any other category. The research also found that initially all echoics emitted by the child were imperfect, as sessions continued the frequency of imperfect echoics decreased.

Rivard and Forget (2012), used direct observation to study verbal behavior in a group of children diagnosed with ASD and their interaction during an early behavioral intervention (EBI) program. The article had three main objectives throughout the study. Objective one was to describe the frequencies of vocal, verbal, and listener behaviors. Objective two entailed the evaluation of relationships between children's level of functioning and their behaviors. Objective three was to provide a topographic description of the consequences provided by the therapist at the early behavioral intervention (EBI) program following a child's behavior (Rivard & Forget, 2012). The study aimed to observe if units of language described within verbal behavior analysis and verbal operants were emitted and promoted in an early behavioral intervention (EBI) program using discrete trial training. The research design of the experiment conducted was a single case, observational study encompassing participants ranging from age three to age five that attended an EBI program (Rivard & Forget, 2012). The participants had not been exposed to any language intervention or other interventions prior to the study. Observations were completed during the first seven weeks of the EBI program (Rivard & Forget, 2012). Thirteen target behaviors were identified via observation; appropriate mand, inappropriate mand, echoic, appropriate textual, inappropriate textual, appropriate intraverbal, inappropriate intraverbal, appropriate tact, babbling, vocal stereotypy, appropriate nonverbal response to a request and inappropriate nonverbal response to a request (Rivard & Forget, 2012). Data from the study suggest that being able to identify truly verbal vocal responses from a verbal behavior analysis perspective was a key component in measuring the children's functioning and the severity of autism. The results from this study indicate that a specific EBI program would benefit from expanding its

functional language goals. In addition, the data show that the majority of the behaviors were followed by nonspecific consequences such as social reinforcers, social requests and verbal behaviors. The study presents two possible limitations. The first being that the sample size observed was small and that the study would need to be extended. The second limitation was the thoroughness and time required to train staff on the use of the observational grid being used. While this study was only an observational study, they cannot for sure say that EBI is a beneficial program from their findings alone. However, it is noted that EBI is a well-established form of treatment for individuals with ASD, but does present limitations (Rivard & Forget, 2012). One limitation is the generalization of the language learned in discrete trials being transferred to regular and everyday settings.

Tacts and Tact Training/Instruction.

This section describes tact training and/or tact instruction. According to Greer and Ross (2008), individuals may develop or acquire tacts through four different skill sets. The skill sets include: a) new tacts are acquired through incidental teaching or instructionally designed learn units; b) using “wh” questions such as who, what, when, where, why, and how to acquire new tacts; c) tacts are acquired through incidental “naming;” and d) new tacts are acquired via observing the environment. Greer & Ross (2008) define a learn unit as “consisting of potential three-term contingencies for students and at least two interlocking three-term contingencies for teachers; they measure occurrences of antecedents, behaviors, and consequences for both teachers and students during instruction” (p. 31).

Tact capabilities are used as a procedure to teach the meaning of tacts and how tacts can be acquired by students who have deficits in tacting or need new ways to

acquire tacts (Greer & Ross, 2008). Tact capabilities can be further explained as the means by which children with limited verbal behavior can acquire tacts. Tact capabilities have four different variations according to Greer and Ross (2008). The four are acquiring new tacts from direct instruction, teaching students to recruit new tacts independently by asking “wh” questions, teach students to acquire tacts incidentally through naming and through indirect contact with contingencies by observing others (Greer and Ross, 2008).

Lydon, Healy, Leader and Dolleen-Day (2009) studied the effects of daily intensive tact instruction on the emission of verbal operants. The study stated that communication training mixed with intensive behavioral interventions had become a key focus of instruction for children with ASD who present deficits in both their learner and speaker repertoires (Pereira-Delgado, & Oblak, 2007; Pistoljevic & Greer, 2006; Schaffler & Greer, 2006). The goal of communication training was to increase spontaneous speech emitted by the child using several verbal operants including mands and tacts (Pereira-Delgado, & Oblak, 2007; Pistoljevic & Greer, 2006; Schaffler & Greer, 2006). The experimental design used for this research was a delayed multiple probe design across participants (Lydon et al., 2009). Prior to implementation of the intensive tact instruction, unknown stimuli were identified. The five concepts that were identified for this study include occupations, transportation, clothing, locations, and food. Each category composed of four stimuli. Each stimulus was presented to the participants via a picture card. During this presentation, the student was given no antecedent and no feedback. One limitation of this study was that the participants (three- and four-year-olds) were unable to demonstrate the emergence of conversational units due to their limited verbal development. The study concluded that there is a functional relation between the

implementation of daily intensive tact instruction and the number of verbal operants emitted. More specifically, the results indicate a functional relation between daily tact training and the number of tacts emitted. In addition, the current research suggested that intensive tact training may be an effective means to increasing verbal operants, by compensating for what are considered to be missing language opportunities.

Compensating for these missing language opportunities shows a strong correlation in the increasing number of verbal interactions in children with not only ASD, but ASD and other communication delays (Lydon et al., 2009).

Diaz and Perez-Gonzalez (2015) designed a research study that examined the effects of teaching tacts through multiple procedures and the emergence of intraverbals in young children. Diaz and Perez-Gonzalez (2015) operationally defined emergence as when a person responds to a new relation that has not been taught to the individual directly which is later correlated with stimulus equivalence. The current study was broken into two different experiments. The purpose of the first experiment was to assess the development of intraverbals when two tacts that were related were taught in the presence of a single picture. The purpose of experiment two was to assess the development of a single intraverbal following instruction of a tact and the symmetrical intraverbal (Diaz & Perez-Gonzalez, 2015). Participants in this study were ten children, ages five and six. All participants of this study were Spanish-speaking children; therefore, the entirety of the study was conducted in Spanish (Diaz & Perez-Gonzalez, 2015). A multiple baseline design was used for both experiments. Within the multiple baseline design the researchers used a pre-post intervention design with partial control of external variables. Experiment one revealed that there was an emergence of intraverbals when

presented with a picture (Diaz & Perez-Gonzalez, 2015). The data show a relation between the teaching of tacts and the development of intraverbals. This relationship was strongly correlated because the intraverbals emerged without pretraining or familiar stimuli. Experiment two of the study revealed that tacts can encourage the development of intraverbals in children (Diaz & Perez-Gonzalez, 2015). Overall, the study demonstrated that when given some type of tact training, children are able to demonstrate the emergence of intraverbals and complex intraverbals. Research reveals that the teaching phase of this experiment was beneficial in encouraging verbal responding. However, the study presented with several limitations. The first limitation being that part of the experimental design used was a pre-post intervention with most sessions not happening at the same time. The researchers suggest that further studies would need to have a more detailed design in order to replicate this study (Diaz & Perez-Gonzalez, 2015). The second limitation of the study is that during the second experiment, not all of the children showed emergence of intraverbals. There are several variables that could have contributed to the lack of emergence. The authors suggest that these potential variables are addressed in future research. In conclusion, the teaching phase of this experiment should allow children to demonstrate the emergence of intraverbals (Diaz & Perez-Gonzalez, 2015).

Carroll and Hesse (1987) conducted a study to examine the effects of alternating mand and tact training of verbal responses on the acquisition of tacts. The participants included six preschool students; one female and five males. The experimental session took place in a room at the Child Developmental Center. Not all subjects completed the study, however for the subjects that did complete the study the mand-tact training

procedure proved more effective on the acquisitions of tacts than tact training independently. It was noted that less training was needed for the acquisition of both mands and tacts when the training for them was combined. Carroll and Hesse (1987) state that “additional research is needed to clarify these results, but it appears that training time can be economized by alternating the contingencies under which a response form is learned” (p. 63).

Petursdottir, Ólafsdóttir, and Aradóttir (2008) conducted a study to provide an initial evaluation of the effects of tact and listener training on the emergence of bidirectional intraverbal relations of four adolescents who spoke Icelandic as their native language. The sessions took place in an empty preschool classroom in which the participant and researcher sat across from one another. The researchers used a multiple baseline design across stimulus sets to evaluate the effects of either tact training or listener training on the acquisition of two types of intraverbals. Results from the study show that tact training was only reliable in the acquisition of one of the two languages tested. Effects of the listener training were more variable and resulted in only partial acquisition of both the languages tested. It is suggested that the emergent intraverbal relations are not necessarily bidirectional. In addition, it is possible that the training of different relations may differentially effect the type of unidirectional relations that emerge. One limitation of this study is that the participants were slightly older than participants of other previous studies, therefore developmental differences cannot be ruled out.

Schauffler and Greer (2006) conducted a study to test the effects of teaching environmentally accurate tacts on young adolescents’ emission of accurate tact and

conversational units during the school day using a multiple baseline design across participants. Participants of the study were two eighth grade students; one male and one female, both diagnosed with emotional and behavioral disorders. Sessions for the study took place in an eighth-grade classroom at a middle school. The middle school had used the Comprehensive Application of Behavior Analysis to Schooling (CABAS) model for the past three years. Independent variables in this study consisted of a procedure that taught the students to emit accurate tacts to novel sets of stimuli. The dependent variables in this study were the number of accurate tacts and accurate conversational units emitted by the student during two transitional times and a free period. The results of this study showed an increase in accurate tacts and conversational units emitted by both students following the implementation of the intensive tact procedure. Results from this study also showed that even though both students' number of accurate tact and conversational units increased the number of inaccurate tacts and conversational units did not change from the baseline to treatment phases. There were a few limitations noted by the researchers. The first limitation was that the study would need to be replicated with more participants like the ones that participated in this study. Second, future research should also be done to identify how many sets of stimuli need to be taught before significant effects accrue.

Third, future research is needed to control for the number of learned units received daily.

Delgado and Oblak (2007) conducted a study to test the effects of an intensive tact protocol for three preschool participants with developmental delays who emitted low levels of vocal verbal behavior throughout the school day. Researchers used a multiple probe design across participants for this study. The study took place in several locations throughout the school. The independent variable was the daily tact instruction protocol,

the dependent variables were pure tact and pure mands emitted during non-instructional time. Results demonstrated that there was a functional relation between the daily intensive tact training and an increased number of verbal operants emitted in non-instructional settings. These results were consistent across all participants. Researchers identified several limitations with the study. The first was that it was difficult to control the number of learned units presented throughout the day. Second, not all participants received all sets of the stimuli. The third being that one participant engaged in high rates of stereotypy that could have accounted for the lower rates in responding.

Arntzen and Almas (2002) conducted this research to extend the generality of the Carroll and Hesse (1987) study by including children and youths with autism and other developmental disabilities. This specific study had two purposes. The first being was to explore whether the mand-tact condition was more effective in the acquisition of tact responses than the tact-only condition. The second purpose was to determine whether the mand-tact and the tact-only conditions yielded different tact performances on follow-up tests. Two 3-year-old typically functioning females and three boys with developmental delays who displayed characteristics of autism were the participants of the study. The study occurred at a treatment center for two of the participants and at home for the remaining three. The participants were divided into groups, an AB design was used in group one and a BA design was used with group two. The researchers also included a second phase in the study to avoid sequencing effects, a multielement design was used in this phase. Results from this study were consistent with those of Carroll and Hesse (1987) and support the idea that mand contingencies involve stronger controlling variables and that mand contingencies could facilitate the acquisition of tact response. However, the

results display no differences between the procedures and the follow-up test differ from Carroll and Hesse (1987). Further research is needed to identify procedures that urge better long-term maintenance of the newly established skills.

Pistoljevic and Greer (2006) conducted a study to test the effects of an intensive tact instruction on the frequency of pure tacts and mands emitted by students in non-instructional settings. Four male students with low numbers of pure tacts in non-instructional settings were the participants of this study. Non-instructional settings included transition time, lunch and free play. The study was done in a publicly funded, privately ran preschool for children diagnosed with developmental delays and students who were typically developing. Researchers used a multiple probe design across participants for this study. The independent variable identified in this study was the increased daily presentation of tacts. The dependent variable was identified as the number of pure tacts and mands emitted during the 50-minute probes across the three instructional settings listed above. Results of this study demonstrate a functional relation between the intensive daily tact instruction and the number of pure tacts and mands emitted by the students in the non-instructional settings. There was not a significant change in the number and/or rates of mands. Lastly, the rate of tact responses following the intervention provided a time dimension for responses, meaning that we can observe that children were initiating interactions with the experimenters. The initiating interactions with the experimenter displayed that pure tacts occurred at quicker rates. Several limitations were discussed in the article. The first is that it would have been beneficial to teach mastery of more sets of stimuli to some of the participants. The second, data is needed on the number of conversational units and more information is

needed on the mean and range of rates of pure tacts and mands of the students who are typically developing. Lastly, increasing the number of learned units regardless of if the instruction was mand or tact instruction is a possible reason why pure tacts increased significantly. Future research is needed to isolate the increase in tact instruction from the increase in instruction period.

May, Hawkins, and Dymond (2013) conducted a study to extend previous research by examining the emergence of intraverbal responses in children with ASD and language impairment following precise tact training. Three male students with an independent diagnosis of ASD from a school for children and young people with special educational needs were the participants of this study. Sessions for this experiment took place in an empty room in the school, containing only chairs and tables. Researchers used a nonconcurrent multiple baseline across participants design for this study. All participants in the study demonstrated emergent vocal intraverbals. This was demonstrated by correctly answering questions immediately following an instructional history of tacting pictures. A possible limitation of the study is the stability of the pre-test responding in two participants. Both of which showed an increasing trend. Future research should examine consequential intraverbal responses and should seek to ensure the stability of the baseline phase of the research prior to implementation of the intervention.

Lydon, Healy, Leader and Dollen-Day (2009) conducted a study to replicate and expand the findings of two previous studies conducted by Pistoljevic & Greer (2006) and Pereira-Delgado & Oblak (2007). A delayed multiple baseline design was used with two students in preschool as participants. The students both had an autism diagnosis and

attended an ABA preschool five days a week. The tact instruction for the study took place in the participants classroom. The tact instruction for the study took place within the participants regular academic schedules. The independent variable for the study was identified as increasing daily tact instruction by the number of units learned or 100 units. The dependent variables identified for the study were the number of conversational units across three non-instructional settings; schools hallways during transitions, during lunch time and in the play area of the classroom. Additional dependent variables were the number of pure tacts and mands. The research showed a functional relation between daily tact instruction and the number of verbal operants emitted across all non-instructional settings for both of the participants in the study. These findings are similar to the findings of the studies mentioned above, all studies demonstrated that tact instruction was an effective way to increase tacts in non-instructional settings. Future research should continue to examine the properties increasing tact repertoires.

Grannan and Rehfeldt (2012) conducted a study to explore the role that category tact instruction has in facilitating the emergence of intraverbals. More specifically in addition to matching-to-sample instruction. The participants of the study were two five-year-old children with an autism diagnosis. The children were recruited from Southern Illinois University Carbondale's Center for Autism Spectrum Disorders. The researchers used a concurrent multiple probe design across participants for this study. The dependent variables identified were the number of correct answers to questions about items in a category and correct responses per trial block. The independent variables for the study were tact instruction, match-to-sample instruction and intraverbal probes. The results from this study support that teaching of tact and categorization skills can aid the

emergence of intraverbals. One limitation of this study is that the design does not allow researchers to determine if tact and match-to-sample instruction were both necessary for the emergence of intraverbal responses or if one or the other would have been enough.

Delfs, Connie, Frampton, Shillingsburg and Robinson (2014) evaluated the efficiency of listener and tact instruction for children with ASD. The primary purpose of the study was to assess and compare effects of listener training on tact emergence and the effects of tact training on the emergence of listener relations. The secondary purpose was to begin to evaluate the level to which collateral responding might facilitate the emergence of bidirectional relations. Participants for the study were four males ranging from ages three to eight-years-old, all with an autism diagnosis or a diagnosis of pervasive developmental disorder not otherwise specified. All sessions for this study were conducted in the setting that the participants received services. The research design used for this study was a modified parallel-treatments design. The research concluded that tact training was just as, if not more effective than listener training across all participants. The study supported previous studies that had concluded that tact instruction is likely to produce emergent listener relations. The study had some limitations, one being that tact probes always occurred before listener probes. Second the study did not have procedures in place for the maintenance of skills that had been previously acquired. Lastly there was no fidelity data taken to ensure the correct implementation of each intervention. According to the researchers, further research should focus on variables, which they listed as maintenance, number of trials per session and error correction trials.

Listener Responding Skills

This section describes and reviews literature on listener responding skills, a concept used within the current literature.

Lorah and Karnes (2016) conducted a study to evaluate the use of iPad and the application *Language Builder* in the acquisition of the listener responding skills. The study also evaluated generalization of this skill to the use of flashcards. The participants were two children, preschool age with a diagnosis of autism. The autism diagnosis was received from a developmental pediatrician, independent of this research project. Sessions for this study took place in a small classroom within a university clinic setting. The classroom was set up for individualized instruction and contained child sized table and chairs. Researchers used a multiple baseline across labels, which the researchers described as a variation of multiple baseline across behaviors. Researchers were measuring percentage of correct responses following the use of the *Language Builder* application on an iPad. The study showed that the *Language Builder* application allowed participants to gain listener responding skills required to “touch” pictures in an array of cards. The researchers also list several limitations, the researchers did not wait for the data to stabilize in baseline prior to introducing the intervention. Second was the research design. The participants within the study showed an increasing trend prior to entering the training phase, or without intervention. The third was that both participants showed an increase in target skills prior to the introduction of the intervention. Future research should replicate the study with more participants and/or a different research design. Researchers suggest using a multiple probe design to eliminate potential for overexposure to other targets within the study.

Causin, Albert, Carbone and Sweeny-Kerwin (2013) conducted a study to extend current research on using joint control to teach children with autism within a private clinic that provides educational services to individuals with autism and other developmental disabilities. The participants were three boys ranging from age six to seventeen with a diagnosis of autism, pervasive developmental disorder and/or attention deficit hyperactive disorder. The study measured cumulative number of trained and untrained stimulus sets acquired during probes. A multiple probe across participants design was used for the study. The researchers described their most notable finding was that all participants emitted correct responses to untrained stimulus sets. The researchers identified three limitations to the study. The first limitation was that the same 12 stimuli were used in the 50 or more stimulus sets, across all participants. The second limitation was that participants were not required to emit tact responses of the experimental stimuli during the selection tasks. The last limitation was that the researchers only collected results on three participants and the results from these three was highly variable.

Stimulus Equivalence

This section describes and reviews the literature on stimulus equivalence. This section will cover a review of literature covering the importance of stimulus equivalence as a concept and the literature covering stimulus equivalence with children.

Eilifsen and Arntzen (2017) conducted a study to examine the likelihood that developing participant-defined classes is affected by stimulus equivalence retention test. In addition, the study examined if inclusion of a stimulus equivalence test immediately following conditional discrimination training has an effect on performance. Participants of this study were 27 young adults between the ages of 16 and 43. The participants were

all recruited through personal connections as well as through a community center for young adults. Sessions took place in front of a table in an office cubicle within a larger room. Participants of this study were assigned to one of two test groups. The only difference in the test conditions was whether the stimulus equivalence test followed the establishment of the prerequisite conditional discriminations was included. Results from this study do not illustrate that immediate testing for stimulus equivalence following the training will enhance stimulus equivalence performance after a delay of weeks. However, the results from this study do illustrate that stimulus equivalence classes can be tough to maintain over long periods of time. Future research should attempt to identify variables that can ensure continued stimulus control within stimulus equivalence classes over long periods of time.

Avellaneda et al. (2016) conducted a study to determine if variation in the contingency influences the performance of subjects in each group. The participants of this study were 30 women between the ages of 18 and 32. The study took place at table with a laptop, with a laptop in front of the participant. which the participants used to complete computerized tasks. Comparing different groups, the number of subjects who reached the criterion for some or all relations during the test was higher in one group than the other two, these results were similar to the final study conducted. Researchers note that these results indicate that the degree to which stimuli are contingent does influence the learning of baseline relations and the development of derived relations. Limitations of the study include the use of only two stimulus classes, that previous research suggest that the use of at least three classes increases the subject's success. Secondly, the number of times that the participants were exposed to the training-testing cycle. The researchers

noted that if all of the subjects had been exposed to the training trial more there may have been a greater improvement. Future research should examine if the same results from this study would be obtained if researchers were to use a positive or zero contingencies with different trial proportions

Haegele, McComas, Dixon and Burns (2011) conducted research to study if teaching conditional discriminations to a group of students would result in the emergence of stimulus equivalence among an actual number, their equivalent word in English and their equivalent Ojibwe or Dakota words. The study's participants were 36 pre-Kindergarten aged students. The study took place at a public Native American culture and language heritage school. The dependent variable was the percentage of correct match-to-sample trials. The independent variable was the computerized intervention versus absence of the computer intervention. Results from this study showed that participants who received the computer training performed significantly better than the students who did not have the computer intervention. This research provides evidence that match-to-sample procedures administered through computerized instruction can be effective in teaching components of a second language to students who are of pre-kindergarten age. The study listed several limitations, one being that the groups in the study were relatively small, with only six students in each intervention group. Second is that the study was only teaching Ojibwe and Dakota words to students who were currently receiving instruction on those two languages. Third, that the study only included a generalizability test. Future research should focus on the effects of stimulus equivalence and derived relational responding on language acquisition and complex

cognitive responding. Future research should also seek to replicate the current study with different populations.

Plazas and Cortes (2017) conducted a study to establish if exclusion performance is a prerequisite to the formation of equivalence classes in preschoolers. The study was broken up into two experiments. The first was a within-subject comparison between exclusion performance and equivalence class formation. The participants of this experiment were twenty-two children between the ages of four and six. Sessions took place in a room within the student's school. Results show that the majority of participants did not establish equivalence relations. However, scores in exclusion were high among both groups of participants. Overall, results show an obvious independence of the symmetry from the exclusion and transitivity performance. One limitation is that introducing exclusion test in the same phase as the symmetry and transitivity relations might have had an effect on latter relations. Therefore, the researchers implemented a second experiment which evaluated exclusion and equivalence class formation independently. This experiment included twenty children between the ages of four and six. The second experiment took place in the same setting as the first experiment. This experiment replicated the results from experiment one even though exclusion performance was assessed independently from symmetry and transitivity. Researchers did not state limitations or suggestions for further research.

Grisante and Rose (2014) evaluated controlling relations in stimulus equivalence classes of preschool children and individuals with Down syndrome. Two different training procedures were used to look at emergent stimulus-stimulus relations. Experiment one included five typically developing children of preschool age, one child

with Down syndrome and two adults with Down syndrome. The first experiment had a pre-training condition, training condition and a testing phase. The pre-training condition was used to develop a matching-to-sample (MTS) baseline. The training condition included AB and BC stimulus-stimulus relations. If participants did not meet the predetermined criteria the procedure of this condition was repeated. During the testing phase of experiment one there were equivalence probes and stimulus control topography (SCT) probes. Equivalence probes were used to test for emerging stimulus-stimulus relations. This probe was completed three times minimum and if a participant did not demonstrate emerging stimulus-stimulus relations or stimulus equivalence the entire training and probe session were repeated. The second probe condition was the SCT probe which was used to evaluate if the participants in the study had developed both select and reject relations on specific trials (Grisante & Rose, 2014). The second experiment in this study used blank comparison procedure to train AB and BC select and reject relations. This experiment's primary purpose was to address the question of if training aimed at the development of select and reject relations would correlate with more reliable class formation. Similar to experiment one the second experiment included several conditions; pre-training, AB and BC training relations, CA and AC equivalence probes, SCT probes, class expansion training and class expansion and SCT probes (Grisante & Rose, 2014). The study's first purpose was to assess equivalence class formation following matching-to-sample training in multiple conditions. Secondly, the study wanted to address the use of stimulus probes to evaluate select and reject SCTs. Grisante and Rose (2014) noted that the repeating of testing and training appeared to be beneficial in establish equivalence class formation. The authors of this article express that in future research to

examine the use of blank comparison procedures for SCT test and not just for training purposes.

LeBlanc, Miguel, Cummings, Goldsmith and Carr (2003) conducted a study to directly compare three testing procedures to assess emergent performance of children diagnosed with autism. The study was also conducted to extend applied research on stimulus equivalence with individuals who have autism to a common academic topic (i.e., US geography). The participants of the study were two male children with an autism diagnosis. One participants sessions were conducted in a room separate from the classroom and the others was in a separate area within the classroom. The research suggests that variations in procedures that may include reinforcement for responses is appropriate for children with disabilities. In addition, the results show that the use of matching to sample procedures for teaching US geography to children with autism shows positive results. There were three potential limitations of this study; The first being that the study was small and only included two participants. The second limitation being that the most difficult relation was always tested first. Lastly, no procedural integrity data were collected.

Key Terms

1. Applied Behavior Analysis (ABA): “The science in which tactics derived from the principles of behavior are applied to improve socially significant behavior and experimentation is used to identify the variables responsible for the improvement in behavior” (Cooper et al., 2007, p. 690).

2. Constant time delay: Errorless learning procedure using a predetermined systematic controlling prompt provided after a delay. The prompt is naturally faded as correct responses are provided prior to the prompt (Collins, 2012).
3. Cooper et al. (2007) define stimulus generalization as “when an antecedent stimulus has a history of evoking a response that has been reinforced in its presence, the same type of behavior tends to be evoked by a stimulus that share similar physical properties with the controlling antecedent” (p. 705).”
4. Cooper et. al (2007) define generalization as “when an antecedent stimulus has a history of evoking a response that has been reinforced in its presence, the same type of behavior tends to be evoked by a stimulus that share similar physical properties with the controlling antecedent” (p. 705).
5. Learn Unit: Consist of potential contingencies for students and teachers, measuring the occurrence of antecedents, behaviors and consequences for teacher (Greer & Ross, 2008).
6. Mand: The action of an individual requesting (Greer & Ross, 2008).
7. Preference Assessment: Observation or trials used to determine an individual’s preferences. Often used to determine strong preferred reinforcers for a student (Chazin & Ledford, 2016)
8. Stimulus Equivalence: Emergence of accurate responding to stimuli that are untrained and stimuli that are not reinforced (Cooper et al., 2007).
9. Tact: The action of an individual labeling (Greer & Ross, 2008).

Summary

In conclusion, verbal behavior analysis has been influential and beneficial for children with ASD. Both tact and listener training have been implemented across several different settings with both children with disabilities and typically developing children. Both trainings have had a positive impact on these individuals. However, there is a lack of research using tact training to develop the emergence of intraverbals through stimulus equivalence. There is also a lack of research of the emergence of intraverbals when tact training is implemented. Therefore, additional research is needed to investigate the emergence of intraverbals via stimulus equivalence in relation with tact training.

Method

Participants and Selection Criteria

Participants of this study were students with autism spectrum disorder (ASD) with emerging but limited tacting skills. Each child's total tacts were 200 or less nouns and/or verbs (or other parts of speech). Students selected for this study met the following criteria: (a) had a diagnosis of ASD; (b) received special education services; (c) attended a private day school and were referred by their teacher; (d) scored approximately on level two of The Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP), with the ability to tact approximately 25 items (nouns), 10 ongoing actions (verbs) and 50 two-component verb/noun or noun-verb combinations; and (e) and the ability to gain parental consent and student assent. Convenience sampling and teacher referral was used to identify two students who met the criteria. Convenience sampling was also used to identify a teacher participant who met the following criteria; (a) classroom teacher or paraprofessional of the participants, and (b) provide consent for the study.

Andy. Andy (pseudonym) was a 12-year-old Caucasian boy who attended a private day school for students with problem behaviors. The school was located in a small town in the Southeastern United States. Andy participated in the school's Autism Program. He was diagnosed with ASD and Speech-Language Impairment. Andy's teacher noted that he had recently learned how to use a calculator for single step multiplication problems as well as single step addition problems. Andy was able to answer yes/no questions when given a question and then prompted to answer yes or no. For example, "do you want a milk? Answer yes or no." Andy is below grade level in all

academic areas and displayed difficulties attending to lengthy task when he was not given consecutive prompts. He also demonstrated deficits in social skills areas. Andy was selected to participate in this study due to his emerging but limited tacting abilities.

Liam. Liam (pseudonym) was a 9-year-old Caucasian boy who attended a private day school for students with problem behaviors. The school was located in a small town in the Southeastern United States. Liam participated in the school's Autism Program. He was diagnosed with ASD. Liam had difficulties with both listener and speaker language. He also demonstrated deficits in social skills areas. Liam was receiving instruction for letter identification, number identification, and writing his name. Liam was able to verbalize when he wanted to go on a walk or wanted a specific food. Liam's speaker behavior was predominately echoic and short phrases. Liam was able to answer questions when prompted. The prompting that the staff used for Liam was to withhold preferred items and ask "what do you want? Or what do you need?" If Liam did not respond independently he was given two choices. The prompts were used to maximize communication exchange opportunities. Liam was selected to participate in this study due to his emerging but limited tacting abilities. Liam was also referred due to his echoic behaviors. However, Liam did not complete the study due to poor school attendance.

Ms. Smith. Ms. Smith (pseudonym) was Andy and Liam's teacher at a private day school for students with problem behaviors. The school was located in a small town in the Southeastern United States. She received a bachelor's degree in History Education. Ms. Smith has been the lead teacher in this classroom for three years. She was currently finishing a program to become a licensed special education teacher (Adapted Curriculum). Her classroom consisted of six students from 3rd to 6th grade.

Setting

The study was conducted at a private day school on the east coast. The private school collaborated with a local university and offered an ABA clinic. The school served students age 5 to 22 with emotional and behavioral disabilities that created potential barriers to their learning. The study occurred in multiple locations throughout the school. The locations included the student's classroom for both baseline and some of the intervention sessions and the school's multipurpose room for the remainder of the intervention sessions.

Experimenter

This experiment was conducted by a full time graduate student. The student is in the 2nd year of a Masters program in Special Education and Behavioral Specialist Concentration at a local public university. The university was located on the east coast. The experimenter was completing a Behavior Analyst Certification Board approved course sequence that fulfill the coursework requirements to sit for the Board-Certified Behavior Analyst Exam. She had over six years of experience working with students with ASD and other disabilities. The experimenter had a Bachelor's Degree in Communication Sciences and Disorders. A professor who was the behavior specialist concentration advisor and BCBA-D, oversaw the study in its entirety. Three 2nd year graduate students in the same Masters of Education program served as additional data collectors for the study.

Data Collection

The researchers used data collection sheets to record correct independent responses, incorrect responses and prompted responses for the dependent variables within

all phases of the study (See Appendix A, B, C and D). Data was collected using pen/pencil and paper data sheets while observing or while watching the videos on a laptop following the recorded sessions.

Dependent variables. There were four dependent variables within the study. The first and second dependent variables were the independent and/or prompted noun and verb-tact responses. These two dependent variables were classified by independent correct, prompted correct, prompted error, and unprompted error. The third dependent variable was measuring the listener emergence of noun-verb intraverbal combination when given a spoken prompt from the experimenter (“Point to the picture showing noun-verb combination”). The fourth dependent variable was measuring the speaker emergence of noun-verb intraverbal combinations when shown a picture of a noun that was being taught and a verb that was being taught; the ability to vocally state the noun-verb combination when shown a picture. Dependent variables were measured using paper and a writing utensil. The data collectors collected correct and incorrect responses by circling a C or I.

Independent variables. There was one independent variable within the study. The single independent variable was the use of constant time delay (CTD) instruction of tacting nouns and verbs. CTD consisted of two delay intervals, the first is a 0s delay and the second is a 3s delay. CTD was used to teach tacting of nouns and tacting of verbs. CTD can be best described as a systematic and errorless teaching strategy in which a prompt is provided after a predetermined set delay interval, prompts are faded systematically as the learner begins to respond correctly prior to the prompt (Collins, 2012).

Social validity. The experimenter collected social validity data by asking the classroom teacher to complete the social validity questionnaire (see Appendix E). The questionnaire focused on; a) if tact training was an effective procedure to increase a student's verbal repertoire, b) if tact training of both nouns and verbs increase emergence noun-verb intraverbal combinations, c) if tact training of nouns/verbs can be generalized outside of the study when using different modes of presentation, and d) if the procedures used for tact training were useful within the classroom. The questionnaire was composed of ten statements and the teacher was asked to rate the statements on a 1-5 scale. One indicating that the teacher strongly disagreed and five indicating that she strongly agreed. The questionnaire also had a Not Applicable column for statements that the teacher felt she could not adequately rate. The teacher was also given the opportunity to write comments.

Materials

The tact identification cards consisted of laminated cards with an unknown noun printed on them created using *Lessonpix* (Binko & Binko, 2018). Verb identification tasks used videos found online using a *GIF* website. Each video consisted of a short clip displaying an unknown verb (e.g., running). The verb-noun identification cards consisted of laminated cards with a verb-noun combination on them (e.g., a dog running).

Experimental Design

An AB design was used for a within-subject comparison. Cooper et. al (2007) defines AB design as: "A two-phase experimental design consisting of a pre-treatment baseline condition followed by a treatment condition (p. 689)."

For the purposes of this study the A represented the baseline phase and the B represented the tact training. An AB design was used due to the limited number of participants that were a part of the study. In addition, AB design was used due to poor attendance for one of the participants. Typically, stimulus equivalence training measures use pre-and post-test measures for individual students. Each skill is measured prior to implementing the intervention and after to assess the percentage increase or decrease. Rose and Souza (1996) implemented a study using a stimulus equivalence procedure that was broken down into several components. The first was a pre-test, implemented before intervention. During this component, no feedback was given for correct or incorrect responses. The next component of the study was the teaching program. The teaching program was designed to teach students to read a set of 51 training words, using two teaching activities: matching printed-word comparison to dictated-word samples, and a constructed-response task in which students used moveable letters to copy a printed word (Rose & Souza, 1996). The researchers conducted tests or probes periodically to verify if students were acquiring the target skill. Lastly there was testing for generalization. The test for generalization assessed the same skill that was assessed during baseline. Unfortunately, this study was not able to be completed in this manner due to neither student advancing to a post test phase.

Procedures

Baseline. Baseline sessions occurred in the student's classroom and within the school's multipurpose room. The participant and the experimenter were in a room together and the experimenter recorded the data trial by trial. Each baseline session consisted of four tasks. The first component of baseline consisted of a single laminated

card featuring an unknown noun, the student was asked “What is this?” The student’s response was recorded correct or incorrect. The second component of baseline consisted of a short clip that displayed a single verb. This clip was presented via the iPad. The student was asked “what is (noun) doing?” to identify the unknown verb. The student’s response was recorded as correct or incorrect. No error correction procedures were used during baseline and no reinforcement was provided. The third component of baseline consisted of speaker noun-verb intraverbal combinations. A single picture displaying a noun-verb combination was shown to the participant. The experimenter asked, “What is shown in the picture?”. The student vocally answered the question. The student’s response was recorded as correct or incorrect. A correct response was only counted if it contained both components of the noun-verb combination. The final component of baseline consisted of listener noun-verb intraverbal combinations. An array of four photos was placed on a table. The photos showed one correct response and three incorrect responses that represented different variations of noun-verb combinations. If the student was being asked to identify a dog running, there was a picture of a dog running, a horse running, a dog eating and a horse sleeping. The student was asked to identify a specific noun-verb combination.

Tact training on nouns. The intervention consisted of teaching the skill of tacting individual unknown nouns using CTD. The training took place in the student’s classroom as well as in the school’s multipurpose room. The noun-tact training included a single picture laid on the table in front of the participant. During the tact training on nouns, the student was presented with the picture of the noun and asked, “What is this?”

Prompting procedure. The prompting procedure that was used for this study was constant time delay to ensure correct tact responses. The same prompt was used for both phases of intervention; however, they were provided on different delays. The two prompt delays that were used were 0s delay and 3s delay. For 0s delay, a discriminative stimulus was given (i.e., “What is this?”) and the researcher immediately provided the correct answer by pointing to the photo and saying, “dog.” Following the verbalization of the correct answer the researcher allowed the student the opportunity to vocally answer. If the student verbalized the correct answer, specific verbal praise was provided (e.g., “You’re right, that is a dog!”).

For the 3s delay, the discriminative stimulus was presented (i.e., “What is this?”) and a 3s delay followed. At the conclusion of the 3s delay, the correct answer was given by the researcher if the student did not respond with the correct answer during the delay period. Reinforcement was provided for each correct response via specific verbal praise (e.g., “You’re right, that is a dog!”). If the participant was unable to verbalize the correct answer, the correct answer was modeled. An error correction procedure was then implemented, which involved the discriminative stimulus being presented again and the researcher immediately provide the correct answer. Following the delivery of the correct answer, the researcher prompted the participant to say the correct answer (e.g., “This is a dog, say dog.”).

Data collection. Within the tact training on nouns, the data collectors recorded independent correct, prompted correct, prompted error and unprompted error responses. During 0s delay, a prompted correct response was counted when the experimenter immediately provided the correct response and the student verbalized the same response.

A prompted error was counted when the individual provided an incorrect response after the researcher had provided the correct response. If the student did not provide a response or provided an incorrect response the experimenter provided the correct response for the student. Following the delivery of the correct response the experimenter presented the discriminative stimulus again and immediately provided the correct answer. The error correction was not recorded on the data sheet, only the initial response. Independent correct and unprompted error responses were not recorded because they are not possible during the 0s delay phase.

During 3s delay, an independent correct response was counted when a student provided a correct response within 3s of the discriminative stimulus being presented. A prompted correct response was counted when the researcher vocalized the correct answer following the 3s delay and the student immediately vocalized the correct answer in response. An unprompted error was counted when the participant vocalized an incorrect answer in the time between the delivery of the discriminative stimulus and the end of the 3s delay. A prompted error was counted when the 3s delay ended and the researcher vocalized a correct answer. Following the vocalization of the correct answer the individual vocalized an incorrect answer again. An error correction procedure was used during the 3s delay. If the student did not provide a response or provided an incorrect response the experimenter provided the correct response for the student. Following the delivery of the correct response the experimenter presented the discriminative stimulus again and immediately provided the correct answer. The error correction was not recorded on the data sheet, only the initial response.

Tact training on verbs. The intervention consisted of teaching the skill of tacting individual unknown verbs. The training took place within the student's classroom as well as the school's multipurpose room. The verb-tact training included a short video clip that was shown to the participant using an iPad. The participant was asked to vocalize what was happening in the video following the discriminative stimulus, (i.e., "What is the (noun) doing?")

Prompting procedure. The prompting procedure that was used for this study was constant time delay to ensure correct tact responses. The same prompt was used for both phases of intervention; however, they were provided on different delays. The two prompt delays that were used were 0s delay and 3s delay. For 0s delay, a discriminative stimulus was given (i.e., "What is the (noun) doing?") and the researcher immediately provided the correct response by stating (i.e., "He is running."). Following the verbalization of the correct answer the researcher allowed the student the opportunity to vocally answer. If the student verbalized the correct answer, specific verbal praise was provided (e.g., "You're right, he is running!"). If the student did not verbalize the correct answer an error correction procedure was implemented. The error correction procedure involved the discriminative stimulus being presented again and the researcher immediately provided the correct answer. Following the delivery of the correct answer, the researcher prompted the participant to say the correct answer (e.g., "He is running, say he is running.").

For the 3s delay, the discriminative stimulus was presented (i.e., "What is the (noun) doing?") and a 3s delay followed. At the conclusion of the 3s delay, the correct answer was given by the researcher if the student did not respond with the correct answer during the delay period. Reinforcement was provided for each correct response via

specific verbal praise (e.g., “You’re right, he is running!”). If the participant was unable to verbalize the correct answer, the correct answer was modeled. An error correction procedure was then implemented, which involved the discriminative stimulus being presented again and the researcher immediately provided the correct answer. Following the delivery of the correct answer, the researcher prompted the participant to say the correct answer (e.g., “He is running, say he is running.”). Zero second delay was used for six sessions, Andy did not meet the mastery criteria of 80% accuracy or more for both correct noun and verb responses for three consecutive sessions. Therefore, Andy did not advance to the 3s delay intervention.

Data collection. Within the tact training on verbs, the data collectors recorded independent correct, prompted correct, prompted error and unprompted error responses. During 0s delay, a prompted correct response was counted when the experimenter immediately provided the correct response and the student verbalized the same response. A prompted error was counted when the individual provided an incorrect response after the researcher had provided the correct response. If the student did not provide a response or provided an incorrect response the experimenter provided the correct response for the student. Following the delivery of the correct response the experimenter presented the discriminative stimulus again and immediately provided the correct answer. The error correction was not recorded on the data sheet, only the initial response. Independent correct and unprompted error responses were not recorded because they are not possible during the 0s delay phase.

During 3s delay, an independent correct response was counted when a student provided a correct response within 3s of the discriminative stimulus being presented. A

prompted correct response was counted when the researcher vocalized the correct answer following the 3s delay and the student immediately vocalized the correct answer in response. An unprompted error was counted when the participant vocalized an incorrect answer in the time between the delivery of the discriminative stimulus and the end of the 3s delay. A prompted error was counted when the 3s delay ended and the researcher vocalized a correct answer, then the individual vocalized an incorrect answer for a second time. An error correction procedure was used during the 3s delay. If the student did not provide a response or provided an incorrect response the experimenter provided the correct response for the student. Following the delivery of the correct response the experimenter presented the discriminative stimulus again and immediately provided the correct answer. The error correction was not recorded on the data sheet, only the initial response.

Noun-verb intraverbal emergence probes. This task assessed the emergence of noun-verb combinations. The nouns and verbs used for the combinations during this phase were nouns and verbs that were used in the noun and verb-tact training. A discriminative stimulus was delivered (i.e., “which card shows a dog running?”). In addition, the participants had the opportunity to respond vocally, the participants were asked (“what is shown in the picture?”). Data was taken on both speaker and listener responses to show mastery.

This task was conducted similar to the baseline procedures. The participant completed this phase within the school’s multipurpose room. The participant and the experimenter sat together at a table and the experimenter recorded the data. The first part of the noun-verb intraverbal emergence allowed the participants the opportunity to

answer. The participant was shown a single picture of a noun-verb combination and the experimenter asked, “what is shown in this picture?” The student then had to verbally answer the question. Answers varying in tense were not counted as correct. For example, if the target response was dog running, dog run was not accepted. The second part of noun-verb intraverbal emergence gave the participants the opportunity to answer using listener responding skills. An array of photos was placed in front of the participant. Each photo showed a different noun-verb combination. The investigator asked the student to point to the card depicting the stated noun-verb combination (e.g., “Point to the dog running”). The student’s responses were recorded as correct or incorrect. A correct response was counted only if it contained both components of the noun-verb combination. No error correction procedures were used during this phase and no reinforcement was provided. Probes were scheduled to occur every fourth session.

Interobserver reliability. To assess the reliability of the data collected, Interobserver agreement (IOA) was assessed throughout the study. IOA is described as the degree to which two or more observers report the same values after measuring the same events (Cooper et al., 2007). Trial-by-trial IOA was used to calculate the IOA for independent noun-tact responses, independent verb-tact responses and individual verb-noun identification responses. Trial-by-trial IOA was calculated by dividing the number of trials (items) agreement by the total number of trials (items) and multiplying it by 100 (Cooper et al., 2007).

The second observer collected Interobserver agreement on independent and prompted noun-tact responses, independent and prompted verb responses, independent listener noun-verb intraverbal combinations and independent speaker noun-verb

intraverbal combinations for 45.5% of the total sessions across all phases for Andy. IOA for any participant never dropped below 85%. The average IOA for total sessions across all phases was 95% (range=85-100%). IOA averaged 98% for baseline (range=95-100%). IOA averaged 90% for intervention (range=85-100%). IOA averaged 96% for probe sessions (range=90-100%).

IOA averaged 91% for noun-tact responses across all sessions (range= 85%-95%). IOA averaged 95% for verb-tact responses across all sessions (range= 85%-100%). IOA averaged 100% for listener noun-verb intraverbal combinations across all sessions. IOA averaged 100% for speaker noun-verb intraverbal combinations across all sessions. IOA was not taken for Liam.

Prompted noun-tact responses. Noun-tact responses were only prompted during the intervention phase; therefore, IOA was collected within only that condition for Andy. For prompted noun-tact responses within the 0s delay phase, IOA was collected on 50% of Andy's prompted noun-tact response sessions averaging 88% (range=85%-90%).

Independent noun-tact responses. For independent noun-tact responses during baseline phase, IOA was collected on 40% of Andy's sessions averaging 95% (range=95%).

Prompted verb-tact responses. Verb-tact responses were only prompted during the intervention phase; therefore, IOA was collected within only that condition. For prompted verb-tact responses within the 0s delay phase, IOA was collected on 50% of Andy's sessions averaging 93.3% (range=85%-100%)

Independent verb-tact responses. For independent verb-tact responses during baseline phase, IOA was collected on 40% of Andy's sessions averaging 97.5% (range=95%-100%).

Speaker noun-verb intraverbal responses. Speaker noun-verb intraverbal responses were never prompted due to the design of the study. IOA was collected on 40% of Andy's baseline sessions averaging 100% and 100% of Andy's probe sessions averaging 100%.

Listener noun-verb intraverbal responses. Listener noun-verb intraverbal responses were never prompted due to the design of the study. IOA was collected on 40% of Andy's baseline sessions averaging 100% and 100% of Andy's probe sessions averaging 100%.

Implementation fidelity. Fidelity was measured on the implementation of baseline procedures as well as the tact training implementation using checklist (Appendix F and Appendix G). Fidelity was assessed by an observer who was a graduate student in the same program as the primary researcher. Fidelity was assessed on 36% of the sessions. Fidelity checklist are located in Appendix F and Appendix G. The baseline/probe fidelity sheet allowed the data collector to score yes, no or not applicable. The intervention fidelity sheet allowed the data collector to score yes, no or not applicable. Data collectors scored all statements "yes" during the baseline/probe sessions. Therefore, baseline/probe sessions were implemented with 100% fidelity. Data collectors scored all statements "yes" during the intervention implementation sessions. Therefore, intervention implementation was implemented with 100% fidelity.

Results

The research questions that guided this study were: (a) is tact training an effective procedure to increase a student's verbal repertoire? (b) can tact training of both nouns and verbs increase emergence of noun-verb intraverbal combinations? (c) can tacting of both nouns, verbs, and noun-verb combinations be generalized in the classroom with a teacher? (d) do teacher(s) and/or paraprofessional(s) view the procedures acceptable and useful within the classroom? This section will describe the results for all of the dependent variables from this study.

Baseline

Baseline consisted of five data points before the intervention began. Andy's baseline data for nouns was at a low level with no trend. The data are slightly variable (Figure 1). Andy's baseline data for verbs was at a low level with no trend. The data are stable (Figure 1). Andy's baseline data for speaker noun-verb intraverbal responses were at zero rates, the behavior did not occur during baseline (Figure 2). Andy's baseline data for listener noun-verb intraverbal responses were at a low level. The data are stable with the exception of one data point; the last data point is higher than the previous data. (Figure 2). Due to time constraints, intervention began following the fifth baseline session, despite the increasing trend in the listener noun-verb intraverbal responses.

Liam's baseline data for nouns were at zero rates; there were not enough data to report trend, with a mean of zero (Figure 3). Liam's baseline data for verbs were at zero rates; there were not enough data to report trend, with a mean of zero (Figure 3). Liam's baseline data for speaker noun-verb intraverbal responses and listener noun-verb

intraverbal responses were at zero rates, there were not enough data to report trend (Figure 4).

Intervention and Probes

Intervention for Andy consisted of six data points following the intervention. The first phase of intervention was a 0s delay, Andy's intervention data is shown in Figure 1. Zero second delay was used for six sessions. Andy's correct verb responses were at a low level with no trend. The data were slightly variable. Andy's correct noun responses were at a mid to high level with an increasing trend. The data were slightly variable. Andy did not meet the mastery criteria of 80% accuracy or more for both correct noun and verb responses for three consecutive sessions. Therefore, Andy did not advance to the 3s delay intervention. Liam never advanced to the intervention phase of the study.

Probes for Andy consisted of one data point for each of the targets being assessed. Probes were used to assess the emergence of speaker noun-verb combinations and listener noun-verb combinations. Probes were scheduled to occur every fourth session following baseline. Andy's probe data is shown in Figure 2. Due to only one probe session being implemented the researcher was unable to conclude the trend, level, and/or variability of the data. The emergence of both listener and speaker noun-verb intraverbal combination were only probed once due to the data collected in the intervention phase. Andy's data were not increasing in trend therefore the researcher did not probe the combinations. Since the participants had not learned the nouns and verbs yet, probes were not practical at this time in the study. Probe sessions were never implemented for Liam.

Social Validity

The teacher, Ms. Smith, who participated in this study answered a social validity questionnaire to determine her perception of the effectiveness of tact training on the emergence of noun-verb intraverbal combinations. Ms. Smith also had the option to write additional comments below the survey. The results from the social validity questionnaire are located in Appendix E. The questionnaire instructed Ms. Smith to rate the degree to which she agreed or disagreed to the statements presented. The scale was labeled with numbers one through five, with one labeled as strongly disagree and five labeled as strongly agree. In addition, there was a Not Applicable column for statements the teacher did not feel she could adequately rate.

Ms. Smith strongly agreed (score 5) with the statement regarding labeling sessions not being intrusive to the daily routine. She scored a 4 for the following statements, “Labeling things is important when working with students who have limited tacting abilities”, “I will use labeling with other students in the future”, “if the opportunity presents itself I will continue labeling outside of the classroom for generalization purposes” (for both Andy and Liam) and “labeling is a socially acceptable and useful training within the classroom.” Ms. Smith did not score any of the statements a 3. She scored a 2 for the following statements, “The student (Andy) showed an increase in his/her verbal repertoire” and “the student (Andy) showed the emergence of noun-verb combinations.” Ms. Smith did not score any of the statements a 1. Lastly, the teacher scored Not Applicable for the following statements, “The student (Liam) showed an increase in his/her verbal repertoire” and “the student (Liam) showed the emergence of noun-verb combinations.” In addition, Ms. Smith commented that “because Liam was

absent from school for most of the study, it was difficult to determine whether the labeling strategy was effective for him.”

Discussion

The purpose of this study was to evaluate the effectiveness of tact training for students diagnosed with ASD. This study also sought to examine if stimulus equivalence would be demonstrated through the acquisition of intraverbal responses. This study used systematic instruction, specifically constant time delay to teach students to tact nouns and verbs. In addition, the researcher sought to determine if the procedures used were socially valid.

Research Question 1: Is tact training an effective procedure to increase a student’s verbal repertoire? Results of tact training on increasing a student’s verbal repertoire are shown in Figure 1 and Figure 3. Andy showed a low level of independent noun and verb-tact responses in baseline. During intervention Andy’s correct verb responses were at a low level with no trend. The data were slightly variable. During intervention, Andy’s correct noun responses were at a mid to high level with an increasing trend. The data were slightly variable. Andy’s correct noun responses increased during the 0s delay, however his correct verb responses never increased. The 0s delay verbal prompting was ineffective. The participant did not respond to the verbal prompt provided during the 0s delay intervention phase. In addition, the error correction procedures were not beneficial because following the implementation of the error correction trial, Andy would continue to vocalize an incorrect response. Constant time delay is an errorless learning procedure, that should ensure correct responses from the learner. It can be inferred that the instructional methods and/or the prompting strategies

used were not implemented correctly. Specifically, error correction procedures were not applied correctly by the researcher. The student did not demonstrate waiting behavior and began speaking the second the materials were presented to him. The researcher attempted to provide the student with an immediate verbal prompt, however the student would often speak at the same time as the researcher. Future researcher should look at implementing listener-behavior training prior to tact training.

Research Question 2: Can tact training of both nouns and verbs increase emergence of noun-verb intraverbal combinations? Based on the limited data, it is unclear if tact training of both nouns and verbs increased the emergence of noun-verb intraverbal combinations. For this study, the researcher was unable to conclude if Andy acquired the nouns or verbs since a 3s delay intervention was never implemented. Therefore, there was no chance for noun-verb intraverbal combinations to emerge. The data in Figure 2 display the Andy's baseline results for noun-verb intraverbal responses. Figure 1 shows one probe session data point for noun-verb intraverbal responses for Andy. Andy's last session of baseline for listener noun-verb intraverbal responses shows an increase in correct independent responses. However, looking at the probe data available, both speaker and listener intraverbal responses remain at a low level. Therefore, the researcher was unable to conclude the effectiveness of tact training on the emergence of noun-verb intraverbal combinations.

Research Question 3: Can tacting of nouns, verbs, and noun-verb combinations be generalized in the classroom with a teacher? Due to time constraints, inconsistent attendance and inclement weather the researcher was unable to tell if tacting of nouns, verbs, and noun-verb combinations can be generalized in the classroom with a

teacher. Neither Andy or Liam advanced through the study enough to participate in the generalization phase. For the participants to advance to the generalization phase they would have first needed to meet a mastery criteria of 80% accuracy or more for three consecutive sessions within the 0s delay phase for both nouns and verbs as well as 80% accuracy or more for three consecutive sessions within the 3s delay phase for both nouns and verbs. Generalization would include generalizing the skills across people (the experimenter to the teacher and/or paraprofessional) and setting (familiar locations within the school building to unfamiliar locations within the school). The generalization phase would be conducted after the baseline, 0s delay intervention and the 3s delay intervention.

Research Question 4: Do teacher(s) and/or paraprofessional(s) view the procedures acceptable and useful within the classroom? The teacher, Ms. Smith, who participated in this study answered a social validity questionnaire to determine her perception of the effectiveness of tact training on the emergence of noun-verb intraverbal combinations. She also had the option to write additional comments below the survey. The results from the social validity questionnaire are located in Appendix E. On the questionnaire, Ms. Smith rated the degree to which she agreed or disagreed to statements on a scale. The scale was labeled with numbers one through five, with one labeled as strongly disagree and five labeled as strongly agree. In addition, there was a Not Applicable column for statements the teacher did not feel she could adequately answer.

Ms. Smith strongly agreed (score 5) with the statement regarding labeling sessions not being intrusive to the daily routine. She scored a 4 for the following statements, “Labeling things is important when working with students who have limited

tacting abilities,” “I will use labeling with other students in the future, “If the opportunity presents itself I will continue labeling outside of the classroom for generalization purposes (with both students),” and “labeling is a socially acceptable and useful training within the classroom.”

Limitations

There are several limitations to the current study. First, only two participants participated in this study. One of the two participants was dropped from the study due to poor attendance and never completed baseline. Therefore, close attention should be made to this when evaluating the data presented within this study. The other participant also did not complete the study. Research should replicate similar interventions of tact training on nouns and verbs with more students diagnosed with ASD.

The second limitation of the current study was the limited number of sessions that occurred throughout the study. There were limited opportunities to implement the study. The limited opportunities were due to inclement weather, student absences, school breaks, and interfering behaviors both from participants and other students in the classroom that occurred prior to sessions that interfered with the ability to implement the sessions. There were two instances when the experimenter was present, however Andy was engaging in problem behaviors and unable to participate in the session. Also, there were eight instances that the experimenter was present and Liam was absent. The student has not been present on the same day as the researcher since the last collected data point, which was collected on 4/10/18. In addition, since the researcher was granted approval from the IRB, Liam was absent 56.6% of the possible school days.

Third, Andy's secondary eligibility is speech-language impairment (SLI), this diagnosis can impact the way a student communicates. Andy's eligibility is not what impacts his communication; however, his speech-language impairment makes the majority of his speech unintelligible to an unfamiliar listener. Secondary data collectors often noted that Andy was unintelligible, therefore they marked incorrect responses for some of the trials based off of the difficulty with understanding.

Fourth, Andy's correct noun responses increased using a 0s delay while Andy's correct verb responses did not increase. There is a limitation with the application of the constant time delay. Constant time delay is an errorless learning procedure and is an evidence-based practice. There should have been more success with the time delay procedure. Therefore, the skills being assessed and the prompting methods used needed to be changed.

The final, and most significant limitation, is that due to the limited amount of data taken for both participants, there was no way to assess if there was a functional relation between the tact training of nouns and verbs and the emergence of intraverbals. In addition, there was no way to compare between subjects.

Contribution to Current Literature

At its current level of completion, this study does not add to the current body of literature. Additional data would need to be taken on both noun and verb responses. The researcher would need the participants to progress through the study to obtain those data. Additional probe data would need to be taken on both listener noun-verb intraverbal responses and speaker noun-verb intraverbal responses.

In conclusion, this study attempted to examine the effectiveness of tact training and stimulus equivalence on emergence of intraverbals in students with autism. Liam never advanced past baseline. Andy did not meet mastery criteria to be advanced from a 0s delay condition to a 3s delay condition. Overall, this study needs extended time and additional sessions to determine the effectiveness of the interventions.

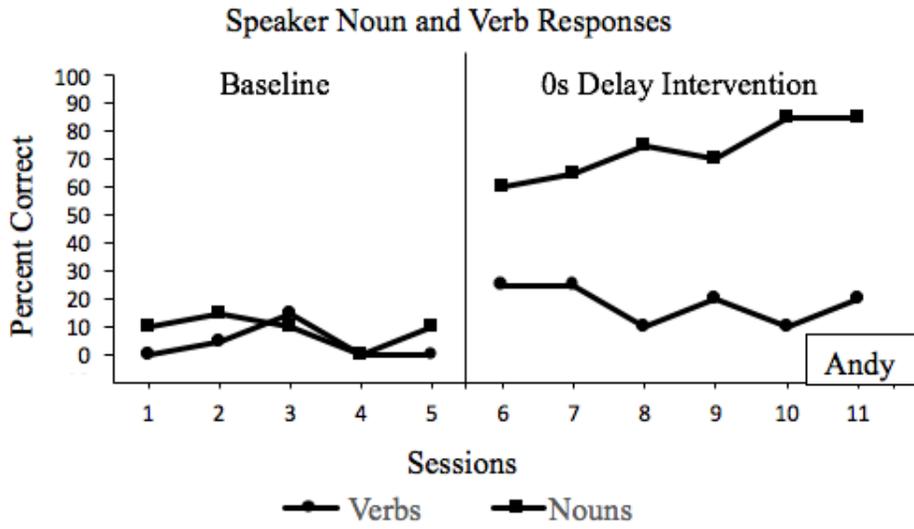


Figure 1. Andy’s graph for speaker noun responses and speaker verb responses.

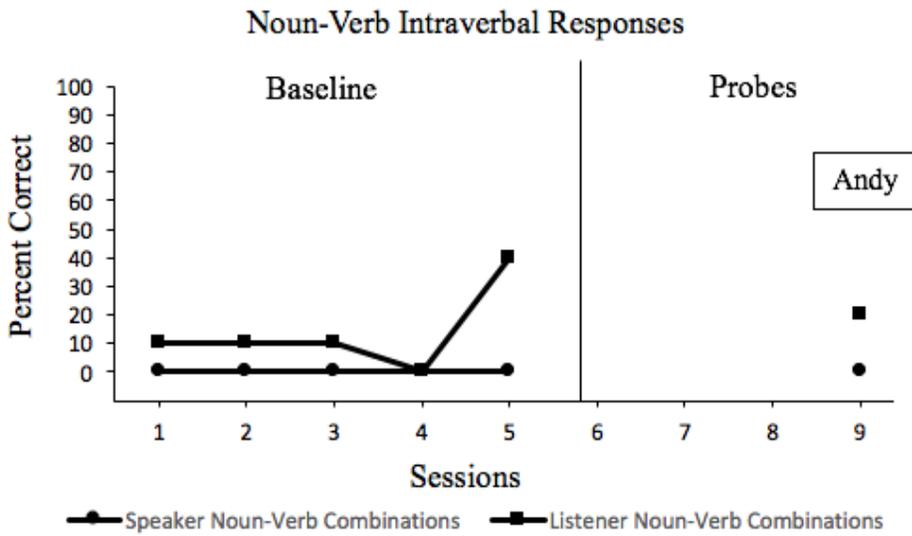


Figure 2. Andy’s graph for speaker noun-verb intraverbal responses and listener noun-verb intraverbal responses.

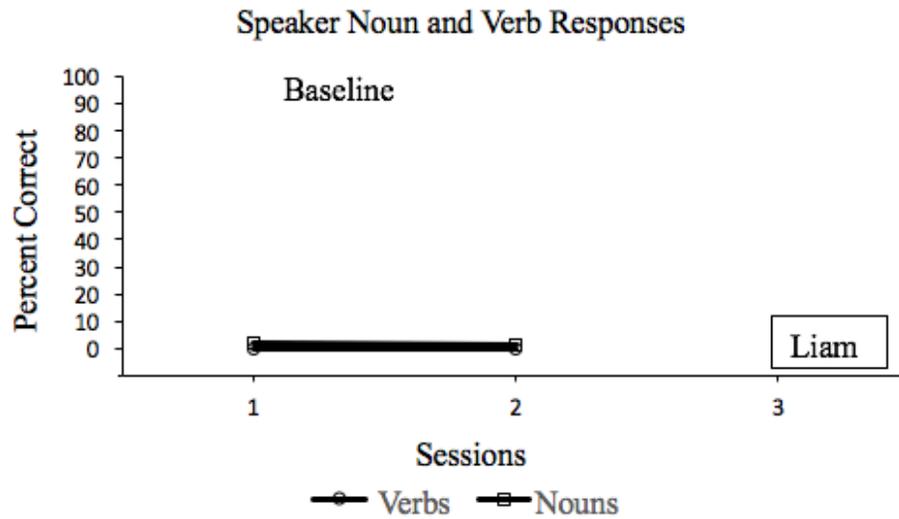


Figure 3. Liam's graph for speaker noun responses and speaker verb responses.

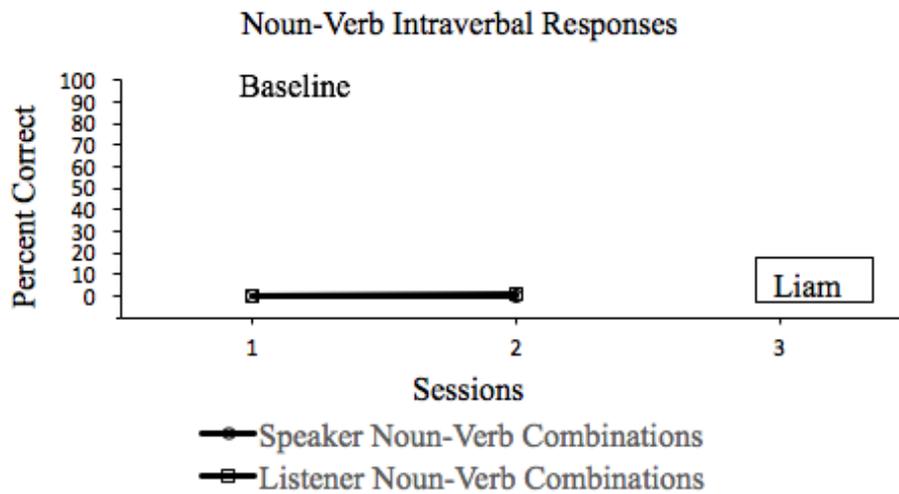


Figure 4. Liam's graph for speaker noun-verb intraverbal responses and listener noun-verb intraverbal responses.

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APPENDIX A: NOUN-TACT TRAINING RECORDING DATA SHEET

Student Name: _____
delay

Prompt Level: 0 second delay or 3 second delay

Instructions: Circle “C” if the student produces a correct noun response following the discriminative stimulus (SD). Circle “I” if the student produces an incorrect response following the SD (“What is this?”). Incorrect responses will be counted for any response other than the correct one or not responding within 5 seconds of the SD being delivered. Be sure to score under the correct column of before or after the prompt.

Nouns				
Data Collector/ Date	Noun	Actual Word	Before Prompt	After Prompt
	1	Mailman	C I	C I
	2	Laundry	C I	C I
	3	Teacher	C I	C I
	4	Light Switch	C I	C I
	5	Mushroom	C I	C I
	6	Vacuum	C I	C I
	7	Frog	C I	C I
	8	Sink	C I	C I
	9	Tie	C I	C I
	10	Chef	C I	C I
	11	Fireman	C I	C I
	12	Policeman	C I	C I
	13	Doctor	C I	C I
	14	Zebra	C I	C I
	15	Oven	C I	C I
	16	Librarian	C I	C I
	17	Ambulance	C I	C I
	18	Scarf	C I	C I
	19	Comb	C I	C I
	20	Remote	C I	C I
		# of words with Correct responses		

APPENDIX B: VERB-TACT TRAINING RECORDING DATA SHEET

Student Name: _____
 delay

Prompt Level: 0 second delay or 3 second delay

Instructions: Circle “C” if the student produces a correct verb response following the discriminative stimulus (SD). Circle “I” if the student produces an incorrect response following the SD (“What is (noun) doing?”). Incorrect responses will be counted for any response other than the correct one or not responding within 5 seconds of the SD being delivered. Be sure to score under the correct column of before or after the prompt.

Verbs

Data Collector/ Date	Verb	Actual Word	Before Prompt		After Prompt	
			C	I	C	I
	1	Swinging	C	I	C	I
	2	Running	C	I	C	I
	3	Walking	C	I	C	I
	4	Skipping	C	I	C	I
	5	Talking	C	I	C	I
	6	Eating	C	I	C	I
	7	Waving	C	I	C	I
	8	Sleeping	C	I	C	I
	9	Standing	C	I	C	I
	10	Sitting	C	I	C	I
	11	Swimming	C	I	C	I
	12	Driving	C	I	C	I
	13	Singing	C	I	C	I
	14	Kicking	C	I	C	I
	15	Clapping	C	I	C	I
	16	Cooking	C	I	C	I
	17	Writing	C	I	C	I
	18	Drinking	C	I	C	I
	19	Hugging	C	I	C	I
	20	Jumping	C	I	C	I
		# of words with Correct responses				

APPENDIX C: SPEAKER NOUN-VERB COMBINATION EMERGENCE
RECORDING DATA SHEET

Student Name: _____

Instructions: Circle “C” if the student produces a correct verb response following the discriminative stimulus (SD). Circle “I” if the student produces an incorrect response following the SD (“What is shown in the picture?”). Incorrect responses will be counted for any response other than the correct one or not responding within 5 seconds of the SD being delivered.

Noun/Verb Speaker

Data Collector/ Date	Noun/Verb Combination	Combinations	Response	
	1	Frog Driving	C	I
	2	Chef Cooking	C	I
	3	Fireman Waving	C	I
	4	Zebra Sleeping	C	I
	5	Mailman Driving	C	I
	6	Teacher Writing	C	I
	7	Doctor Clapping	C	I
	8	Policeman Eating	C	I
	9	Zebra Running	C	I
	10	Frog Eating	C	I
		# of words with Correct responses		

APPENDIX D: LISTENER NOUN/VERB COMBINATION EMERGENCE
RECORDING DATA SHEET

Student Name: _____

Instructions: Circle “C” if the student produces a correct verb response following the discriminative stimulus (SD). Circle “I” if the student produces an incorrect response following the SD (“Which card shows a (noun + verb)?”). Incorrect responses will be counted for any response other than the correct one or not responding within 5 seconds of the SD being delivered.

Noun/Verb Listener

Data Collector/ Date	Noun/Verb Combination	Combinations	Response	
	1	Frog Driving	C	I
	2	Zebra Running	C	I
	3	Mailman Driving	C	I
	4	Frog Swimming	C	I
	5	Teacher Writing	C	I
	6	Chef Cooking	C	I
	7	Doctor Eating	C	I
	8	Fireman Hugging	C	I
	9	Policeman Driving	C	I
	10	Librarian Writing	C	I
		# of words with Correct responses		

APPENDIX E: SOCIAL VALIDITY QUESTIONNAIRE

Please rate the following on a scale of 1 (strongly disagree) to 5 (strongly agree)

	1 Strongly Disagree	2	3	4	5 Strongly Agree	N/A
1. Labeling things is important when working with students who have limited tacting abilities.				X		
2. I will use labeling with other students in the future.				X		
3. The labeling training sessions were not intrusive to my daily routine.					X	
4. The student showed an increase in his/her verbal repertoire (Andy)		X				
5. The student showed an increase in his/her verbal repertoire (Liam)						X
6. The student showed the emergence of noun-verb combinations (Andy)		X				
7. The student showed the emergence of noun-verb combinations (Liam)						X
8. If the opportunity presents itself I will continue labeling training outside of the classroom for generalization purposes (Andy)				X		
9. If the opportunity presents itself, I will continue labeling training outside of the classroom for generalization purposes (Liam)				X		
10. Labeling is a socially acceptable and useful training within the classroom				X		
Comments: Because Liam was absent from school for most of the study, it was difficult to determine whether the labeling strategy was effective for him.						

APPENDIX F: BASELINE/PROBE SESSION FIDELITY FORM

Observer: _____ Researcher: _____ Date: _____

Baseline/Probe Session Fidelity Form

Baseline/Probe Session Procedures:	Yes	No	N/A
1. Researcher asks teacher permission before pulling a student from current task to implement research.			
2. Researcher has all materials ready before beginning the session.			
3. Researcher begins each session by asking the participant what they want to work for (reinforcers).			
4. Researcher obtains student attention before beginning the session and prior to delivering a discriminative stimulus (SD).			
5. Researcher does not provide prompts			
6. Researcher records data immediately after each discrete trial ends.			
7. Researcher does not provide specific praise for correct or incorrect student responses (i.e., no praise for correct responses and no error correction procedures for incorrect responses).			
8. At end of session, researcher provides the student with a reinforcer of their choice and thanks the student for working with them.			
9. Researcher ends session on a positive note.			
Score (out of 9)			

APPENDIX G: IMPLEMENTATION FIDELITY FORM

Observer: _____ Researcher: _____ Date: _____

Intervention Implementation Fidelity Form

Implementation Procedures	Yes	No	N/A
1. Researcher asks teacher permission before pulling a student from current task to implement research.			
2. Researcher has all materials ready before beginning the session.			
3. Researcher begins each session by asking the participant what they want to work for (reinforcers).			
4. Researcher obtains student attention before beginning the session and prior to delivering a discriminative stimulus (SD).			
5. Researcher provides necessary prompts, based on the current prompt level.			
6. Researcher records data immediately after each discrete trial ends.			
7. Researcher provides specific verbal praise for correct answers (i.e., you're right, that is a frog).			
8. Researcher does not provide praise for incorrect answers.			
9. Researcher implements an error correction trial immediately following an incorrect answer (error correction is not recorded on data sheet).			
10. At end of session, researcher provides the student with a reinforcer of their choice and thanks the student for working with them.			
11. Researcher ends session on a positive note.			
Score (out of 11)			