ABSTRACT

A Comparison of Tact Interventions on Emergent Intraverbal Responses in Children with Developmental Disabilities

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Many individuals with developmental disorders experience communication deficits, including those with autism spectrum disorders. For some, this includes the underdevelopment of an intraverbal repertoire. A review of the existing literature on tact to intraverbal training showed a majority of the existing body of research has focused on transfer of stimulus procedures. A minority used tact training procedures. This study sought to compare tact training, transfer of tact stimulus, and transfer of echoic stimulus procedures to evaluate for efficiency. Two male children with autism spectrum disorder were taught to name items by category with the three procedures in an adapted alternating treatments design. Results showed that the most efficient prompting technique varied across learners. This confirms previous suggestions that prompting efficiency may vary because of learner idiosyncrasies or learner history. However, tact transfer of stimulus prompting was the most effective across participants.

A Comparison of Tact Interventions on Emergent Intraverbal Responses in Children with Developmental Disabilities

by

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CHAPTER ONE

Introduction

Autism Spectrum Disorders and Communication Deficits

According to the Center for Disease Control and Prevention's Autism and Developmental Disabilities Monitoring Network's surveillance in the year 2010, autism spectrum disorder is present in one in 68 children in the United States (Center for Disease Control and Prevention, 2014). These rates are higher among boys than girls; it affects one in 42 boys and one in 189 girls (Center for Disease Control and Prevention, 2014).

The Diagnostic and Statistical Manual-Fifth Edition defines autism spectrum disorder (ASD) using the following criteria: (a) "persistent deficits in social communication and social interaction across multiple contexts" and (b) "restricted, repetitive patterns of behavior, interests, or activities" (American Psychiatric Association, 2013). Furthermore, these symptoms "must be present in the early developmental period (but may not become fully manifest until social demands exceed limited capacities, or may be masked by learned strategies in later life" (American Psychiatric Association, 2013). These symptoms must "cause clinically significant impairment in social, occupational, or other important areas of functioning," and should not "be better explained by intellectual disorder (intellectual developmental disorder) or global developmental delay" (American Psychiatric Association, 2013).

Part of the first criterion includes an inability to maintain or engage in verbal conversation, and deficits in verbally communicating "interests, emotions, or affect"

(American Psychiatric Association, 2013). Communication deficits are one of the primary markers of autism spectrum disorder (Finkel & Williams, 2001; Secan, Egel, & Tilley, 1989). It is estimated that approximately 25% of individuals with an autism spectrum diagnosis do not possess functional speech (Howlin et al., 2007; Volkmar, Lord, Bailey, Shultz & Klin, 2004). Communication delays can affect an individual's expressive or receptive language or cause repetitive or apparently nonsensical speech (Finkel & Williams, 2001; Maurice, Green, & Luce, 1996).

Failure to develop these types of skills can impair a child with autism spectrum disorder socially, as language is the foundation of many social interactions. Indeed, Cooper, Heron, and Heward (2007) cite the ability to produce verbalizations as crucial to the most socially significant aspects of human behavior. The ability to answer questions meaningfully, identify needed or desired items, and produce conversational speech all contribute to the social functions of language (Finkel & Williams, 2001; May, Hawkins, & Dymond, 2012; Goldsmith, LeBlanc, & Sautter, 2007). A failure to address communication deficits can lead to both internal and external negative outcomes, including anxiety, depression, somatic issues, attention difficulties, and aggression (Howlin et al, 2007; Hartley et al., 2008). Furthermore, Richards, Oliver, Nelson, and Moss (2012) found that individuals with autism spectrum disorder who have a verbal or partly verbal vocabulary are less likely to develop self-injurious behavior.

Applied Behavior Analysis

Applied Behavior Analysis (ABA) is a scientific discipline that has been used to improve deficits and teach new behaviors to children and adults with autism spectrum disorders. ABA uses the principles of behaviorism to shape socially significant,

functional behaviors. Behaviorism maintains that human behavior can be understood through observable antecedent stimuli, behavior responses, and consequence stimuli. It is the philosophy of the science of behavior (Cooper, Heron & Heward, 2007). Behaviorist research began to truly gain speed in the 1920s through the work of John B. Watson. Watson argued for a direct relationship between environmental stimuli and behavioral responses (Cooper et al., 2007). In the 1930s, B.F. Skinner published *The Behavior of Organisms* (1938). Using the principles of behaviorism, Skinner became the forefather of the experimental analysis of behavior. He classified behavior as respondent or operant; respondent behavior was under the control of the consequential stimuli following it, whereas operant behavior was evoked by the stimuli that immediately preceded it (Skinner, 1938). The experimental analysis of behavior focused on operant behavior and a three-part behavior contingency: the antecedent stimulus, the behavior response, and the consequence (Skinner, 1938).

While Skinner was famous for applying his experimental analysis of behavior on pigeons, in the late 1940s and early 1950s, behaviorists began to apply Skinner's principles on human subjects with developmental disabilities (Cooper et al., 2007). This was the beginning of the discipline known today as ABA.

Cooper et al. (2007) operationally define ABA as "the science in which tactics derived from the principles of behavior are applied systematically to improve socially significant behavior and experimentation is used to identify the variables responsible for behavior change (p. 20)." In their seminal ABA piece, Baer, Wolf, and Risley (1968) identified seven primary qualities of ABA. This piece occurred in the first issue of the *Journal of Applied Behavior Analysis (JABA)*.

First, ABA is applied, behavioral, and analytic. This means that it affects socially significant behaviors that are functional for the person exhibiting the behaviors (applied), it targets behaviors that are observable and the actual behavior in need of change (behavior), and that it must be established that a true relationship exists between what the experimenter manipulated and what change occurred in the targeted behavior (analytic) (Baer et al., 1968; Cooper et al., 2007).

In regards to procedures, ABA must be technological and conceptually systematic, meaning that procedures are operationally defined in detail and must be expressed and implemented in terms consistent with behaviorist principles (Baer et al., 1968; Cooper et al., 2007). In regards to treatment results, ABA must be effective and have the ability to be generalized. This means that an ABA treatment can only be considered effective if it produces behavior changes that are socially or functionally significant (Baer et al., 1968; Cooper et al., 2007).

Treatments must also be generalized, meaning that the results show long-lasting behavior change across environments or across behaviors (Baer et al., 1968; Cooper et al., 2007). For example, if a therapist teaches a child to raise his hand to ask for help in a clinic setting, and then the child raises his hand in his classroom (a new environment) in the months following the end of the treatment, this would be considered a successful generalization. If that same child also begins to tap an adult on the shoulder when he needs help at home (a new environment and new behavior) in the months following the end of the treatment, generalization likewise has occurred.

ABA treatments target a variety of socially significant, functional behaviors, ranging from reducing challenging behaviors to improving communication and social

skills. The common foundation for all of these target behaviors, however, is the behaviorist philosophy and ABA characteristics behind them.

Verbal Behavior

B.F. Skinner's *Verbal Behavior* (1957) laid the groundwork for the applied behavior analysis approach to communication interventions. Skinner argued that language is a learned behavior that is governed by the same principles of behavior by which other more visual forms of behavior are ruled. He asserted language is stimulated by a discriminative stimulus and maintained by a subsequent consequence. Utterances are reinforced by another individual; verbal behavior is maintained by socially mediated reinforcers. Skinner classified words by function, or in other words, what the utterance achieves rather than its literal meaning. Skinner called these classifications operants, reflecting the emphasis on the operating function of the word. Skinner identified six primary operants: tacts, mands, intraverbals, echoics, textuals, and transcriptions.

Verbal Operants

A tact in layman's terms is a label; it identifies an object that can be detected through the senses (Cooper et al., 2007). Skinner defines "tact" as "an invented term" for the "verbal operant in which a response of given form is evoked (or at least strengthened) by a particular object or event or property of an object or event" (Skinner, p. 81). For example, seeing a ball and saying "ball" would be an example of emitting a tact. Tacts can be generally reinforced rather than specifically reinforced. This means that seeing a ball and saying "ball" is not necessarily only reinforced by receiving a ball; it can be reinforced by vocal praise, by a tangible item, or by another consequence entirely.

A mand is an utterance that expresses a want or a need. For example, feeling hungry and saying "sandwich please" would be an example of using a mand. It is important to note that mands are under distinct control of a specific reinforcer; the mand directly corresponds to the object it calls for (Skinner, 1957). Furthermore, it is established by a motivating operation, meaning that the speaker must be under a certain state in order to feel the need to emit the mand (Cooper et al., 2007). For example, a person would only ask for a sandwich if they are hungry. Being hungry would be the motivating operation.

Intraverbals have been alternatively named conversational language, question answering, and reciprocal language interactions (Goldsmith et al., 2007). Intraverbals show "no point-to-point correspondence with the verbal stimuli which evoke them" (Skinner 1957). Intraverbals are not specifically reinforced. Intraverbal behaviors include answering questions, conversation, categorization (for example, saying "cat" in response to "name an animal"), identifying items by feature (for example, saying "cat" in response to "name something that meows"), filling in the blanks in songs or rhymes, (such as hearing "Old McDonald had a…" and responding "farm"), or vocal fill-in-the blank tasks (Ingvarsson & Le, 2007; Sundbery 2008; Sundbery & Sundberg in press). Furthermore, Skinner (1957) noted much of small talk consists of intraverbals; for example, hearing "how was your day?" and responding "fine, thank you" would be an intraverbal because there are no similarities or parallels between the antecedent ("how was your day?") and the response.

Echoics, textuals, and transcriptions are all verbal operants in which there is point-to-point correspondence between the stimulus and the response. Point-to-point

correspondence refers to when each part of the stimulus is directly matched in the response (Cooper, Heron, & Heward, 2007).

An echoic is what Skinner calls the "simplest case in which verbal behavior is under the control of verbal stimuli" (Skinner, p. 55). The response *echoes* the stimulus with formal similarity (the response and the stimulus physically resemble each other and they are in the same form—spoken, written, tactile, etc.) (Cooper et al., 2007). Here, the stimulus is spoken and the response is spoken back. For example, hearing "frog" and saying "frog."

A transcription in layman's terms could be described as taking dictation, or the translation from vocal form to written form (Skinner, 1957). It is an operant in which the stimulus is spoken and the response is written, typed, or spelled (Cooper et al., 2007). There is no formal similarity between the stimulus and response (one is spoken and one is written).

A textual operant is a spoken response evoked by a non-auditory verbal stimulus (Skinner 1957). This is in some ways the reversal of a transcription. For example, seeing the word "frog" and saying "frog." Skinner argues it is different from reading because reading implies comprehension and multiple processes at work (Skinner, 1957). A textual response is one that simply recognizes the stimulus and responds without implication of comprehension (Cooper et al., 2007). There is no formal similarity between the stimulus and response (one is written and one is spoken).

Use of Verbal Operants in Communication Interventions

Skinner's theories of language have been shown to have educational utility across interventions for individuals with autism spectrum disorders and other developmental

disorders that are characterized by language delay (May et al., 2012; Greer & Ross 2008 ; LeBlanc et al. 2009; Sundberg & Michael 2001).

The functional independence of Skinner's operants greatly informs the way verbal communication is taught in ABA therapy. Each of the operants, Skinner argued, is functionally independent. This means that saying the word "milk" to communicate the desire for a glass of milk, saying the word "milk" to identify a glass of white liquid, and writing the word "milk" when listening to someone dictate a shopping list all have independent functions even though they are visually and vocally identical. They must be thought of separately, and therefore taught separately. Once these elementary operants have been mastered, they serve as the building blocks for more complex verbal behavior (Sundberg & Michael 2001). Each of these operants can be taught using behavioral principles, mainly through the administration of reinforcement (providing a preferred stimulus or removing an aversive stimulus immediately after a certain targeted behavior that is meant to increase the frequency of that behavior in the future) (Sundberg & Michael 2001). Both discrete trial training and milieu (or naturalistic) teaching (ABA teaching strategies) have been shown to be effective in targeting the development of communication in individuals with autism spectrum disorder. The behavioral approach of teaching language has been shown to be more effective than other techniques in engendering communication in the autism spectrum disorder population and has been shown to be an effective instructional technique for both autism spectrum disorder and other developmental disorders populations (Greer & Ross, 2008; LeBlanc et al. 2009; Sundberg & Michael 2001). This is especially true in cases when the verbal behavior is under specific reinforcement, such as with mands (Sundberg & Michael, 2001).

Although Skinner showed the elementary operants to be functionally independent, it is possible to use the mastery of one operant as a prompt to teach another operant. This is perhaps most clearly understood through an example. A child with autism spectrum disorder has learned to tact the word "cat" in response to a picture card of a cat. The stimulus that evokes the tact is the picture. The child's therapist wants him to learn to answer questions about feature, an intraverbal skill. In this case, the intraverbal stimulus would be "What says meow?" to which the correct response is "cat." The child does not possess mastery of this intraverbal response. To accomplish this, the therapist presents the new intraverbal stimulus, ("What says meow?") then immediately presents the stimulus that does have discriminative control of the word "cat," the picture card. The child then emits the correct response, "cat." The old stimulus (the picture card) is eventually faded out as the word "cat" comes under stimulus control of the new stimulus ("what says meow?"). This is known as a transfer of stimulus procedure because the stimulus control is transferred from one stimulus (in this case, the picture card), to the new stimulus (the question "What says meow?"). This technique is especially common with intraverbal training.

May et al. (2013) report that research on the application of Skinner's behavioral approach to language has been relatively limited when it comes to intraverbal training. Kodak, Fuchtman and Paden (2012) further argue, as did Sundberg and Michael (2001), that intraverbal training is especially excluded from early intervention training curriculum. A great majority of the studies that do exist have focused on the transfer-of-stimulus procedure outlined above using echoic or tact stimuli.

This is concerning because of the functional application of intraverbal teaching. Sundberg and Michael argue that developing an intraverbal repertoire allows greater social, verbal, and nonverbal gains and prepares individuals to engage in conversation. It allows individuals to converse not only about present items (as other verbal operants do) but also about items that are not present (Sundberg & Michael, 2001). Indeed, according to Greer and Ross (2008),

> by engaging children in more complex intraverbals, their senses are extended through the spoken words of others; thus they can vicariously experience what others tell them. Complex intraverbals allow them to learn about he weather, who the new person is on the block, what's for dinner, the latest information about others, and even the experiences that others are having (p.183, quoted in May et al., 2013).

This is a skill human beings engage in every day, and, as functionality and generalizability are two aims of ABA, fits into the parameters of goals worthy to be addressed in ABA therapy.

CHAPTER TWO

Literature Review

In order to better understand the possible relationship between tacts and intraverbal skills, a review of the existing literature on intraverbal training utilizing tacts as either a prompt or training procedure was conducted. The articles identified were analyzed to determine the types of prompts or training that had been implemented and to identify studies designed to compare intraverbal training procedures.

Search Procedures

A systematic online search was performed on the following online databases: Academic Search Complete, Education Research Complete, Educational Research Information Clearinghouse, PsycArticles, PsycInfo, and PsycTests. The search terms "tact" and "intraverbal" were jointly searched. The search was limited to peer-reviewed articles in the English language. If inclusion was not evident based off of the title of the article alone, the abstract was reviewed to determine inclusion. Seventy-one articles were found, with six identified as meeting all criteria.

After the electronic database search, an ancestry search was conducted in the articles meeting all criteria. One additional article was identified. Finally, a hand search through the archives available (up until 2015) of *The Analysis of Verbal Behavior* and the *Journal of Applied Behavior Analysis*, the two most common publications of the articles included was conducted. One additional article was identified through the hand search.

Inclusion Criteria

In order to be included, the articles were required to meet five criteria. First, the article had to be published in a peer-reviewed scholarly journal. Second, the participants in the study had to be human and have a developmental disorder(s). Third, intraverbals had to be identified by the authors and measured as a dependent variable. A variable was determined to be an intraverbal if the authors used the term *intraverbal(s)* to describe the variable. Fourth, tact prompting or tact training had to be implemented as the intervention in the study. Finally, the authors had to identify either tact training or tact prompting as at least one of the interventions implemented in the study.

Data Extraction

Data from the articles were extracted for analysis using the following overarching categories: (a) participants, (b) procedure, (c) dependent variables, and (d) study outcomes. The following information was analyzed regarding participants: (a) number of participants, (b) sex, (c) age, and (d) diagnosis. The procedures were analyzed according to (a) setting, (b) implementer, (c) verbal pretest administered (if any), and (d) type of tact intervention used. The dependent variables category represents the type of intraverbal targeted and measured. Study outcomes were catalogued as a) positive (all participants improved across all intraverbal measures), b) negative (all participants worsened across all intraverbal measures), or c) mixed (participants' success inconclusive or inconsistent (some measures showed improvement, some measures showed worsening)). Furthermore, if the study was comparative, the type of prompt or training that produced the most efficient or effective results was also recorded as (a) tact, (b) echoic, or (c) other.

Results

Eight articles were analyzed as a part of this literature review. The relevant data collected from the studies are summarized in Table 2.1 below.

Participants

Across the eight studies, there were 23 participants. The majority (87%, *n*=20), were male and three (13%) were female. Participants ranged in ages from 3-21 years of age. One participant was between the ages of 0-3. 48% (*n*=11) were between the ages of 3-5. Thirteen percent (*n*=3) were between 6-12. Twenty-two percent (*n*=5) were between 13-18. Thirteen percent were between 19-21. The majority (87%, *n*=20) had a diagnosis of autism or of autism spectrum disorders not otherwise specified. Three participants (13%) had a different diagnosis. These included two participants with cerebral palsy and one with Cockayne syndrome. Cockayne syndrome is a rare genetic disorder characterized by microcephaly, a failure physically grow at a proper rate, extreme short stature, and delayed development (U.S. Department of Health & Human Services, 2016).

Procedures

Setting

Two studies (25%) implemented the procedure in the participants' homes, three (38%) implemented at in a clinic setting, four (50%) in a classroom-type setting, and two (25%) in another setting. These included one non-specified room in the participants' school, and one in a non-specified room at a university.

Table 2.1

Study:	Participants:	Procedure:	Prompt Comparison:	Study Outcome:	Comparison Outcome:
Goldsmith, LeBlanc, & Sautter (2007)	3 males, 7, 5, and 4 years; ASD	Transfer of tact stimulus	n/a	Positive	n/a
Grannan & Rehfeldt (2012)	2 males, 5 years; autism	Tact training, multiple tact training	n/a	Positive	n/a
Ingvarsson & Hollobaugh (2011)	3 males, 4 years; autism	Transfer of tact stimulus	Echoic	Positive across both techniques	Tact (more efficient)
Ingvarsson & Le (2011)	4 males, 3, 5, 5, and 7 years; autism	Transfer of tact stimulus	Text and Echoic	Positive across all techniques	Inconclusive with concurrent chaining; Echoic (more efficient) without
Kodak, Fuchtman, & Paden (2012)	2 males, 4 and 5 years; autism	Transfer of tact stimulus	Echoic plus error correction and cue-pause-point	Mixed across all techniques	Mixed
Luciano (1986)	1 male,13 years; cerebral palsy; 2 females, 15 and 16 years; Cockayne syndrome and cerebral palsy	Transfer of tact stimulus	Prompt delay	Positive across both techniques	Similar results
May, Hawkins, & Dymond (2013)	3 males, 11, 15, and 16 years; autism spectrum disorders	Tact training	n/a	Positive	n/a
Vedora & Conant (2015)	2 males, 21 and 20 years; 1 female, 19 years; autism	Transfer of tact stimulus	Echoic and text (for one participant)	Positive across all techniques, mixed across participants	Mixed

One (13%) of the studies did not specify the setting. Three of the studies (38%) implemented their procedures in more than one setting. Of the studies that implemented a generalization phase, one study implemented the phase in a hallway, and one in an alternative classroom.

Verbal Pretests

Four (50%) of the studies conducted a formal verbal pretest. Goldsmith et al. (2007) used the Behavioral Language Assessment Form, Verbal Fluency subtest of the McCarthy Scales of Children's Abilities. Grannan and Rehfeldt (2012) utilized the Preschool Language Scale (fourth edition). Ingvarsson and Le (2011) used the Peabody Picture Vocabulary Test (fourth edition) and Expressive One-Word Picture Vocabulary Test. May et al. (2013) used the British Picture Vocabulary Scale (second edition).

Implementer

A majority (63%, *n*=5) of the studies were implemented by the experimenter, one (13%) by a teacher, and two (25%) by another individual (one by a therapist and one by a "trainer"). In one study, the implementer was not specified. It should be noted that one of the studies used multiple implementers.

Tact Intervention

A majority (75%, *n*=6) studies used tact prompting as the tact intervention. For example, Goldsmith et al. (2007) used a tact prompt in a transfer of stimulus type of procedure to teach three males ages 7, 5, and 4, with diagnoses of autism spectrum disorders to name items by class ("What are some things you wear?"). A picture of an item that fit into the category was presented to the participant immediately after the

presentation of the question (for example, the experimenter would ask "What are some things you wear?" and then show a picture of a shoe (tact prompt)). Ingvarsson and Hollobaugh (2011) used picture tact prompts to teach three 4-year-old males with diagnoses of autism to answer questions about function and feature ("What says 'moo?'" or "What do you use to tell time?"). The picture was presented to the participant if they did not respond correctly after the question was given.

Two studies (25%) used tact training as the tact intervention. Grannan and Rehfeldt (2012) used tact training to teach two 5-year-old males with diagnoses of autism to name items by class ("What are four body parts?"). Participants were first taught to tact items, then tact the corresponding class, and then taught to physically place pictures of items with a picture of another item within the same class in the style of listener response teaching. May et al. (2013) used tact training to teach three males, ages 11, 15, and 16 with diagnoses of autism to answer questions about fictional characters ("Which monster eats chips?" or "What food does Simon eat?"). Participants were first taught to tact each fictional character and then to tact features of the characters, such as their favorite foods.

A majority of the studies (63%, *n*=5) combined tact interventions with another intervention. These interventions included errorless learning, match-to-sample training, concurrent chaining, error correction, cue-pause-point procedure, echoic prompting, backwards chaining, differential reinforcement, preliminary training of instructions and pronunciation, and vocal feedback. For example, Grannan and Rehfeldt (2012) combined a match-to-sample procedure with tact training to teach two 5-year-old males with diagnoses of autism to identify items by class ("What are four vehicles?" or "What are

four kinds of clothing?"). Participants were first taught to tact stimuli (for example, when shown a picture of a shirt, the participant would say "shirt"), then to tact the category of each stimulus (for example, when shown a picture of a shirt, the participant would say, "clothing"). Then, the participants were taught to match-to-sample. The experimenter would present a picture of an item in one category (for example, "shirt" to represent clothing) and a picture of an item in another category (for example, "car" to represent vehicles). The participant was then presented with a picture of another item in one of the categories (for example, "bus") and told "match." The participant then would be expected to put the "bus" card with the "car" card. In Goldsmith et al. (2007), an errorless-learning and vocal feedback error correction procedures were combined with tact prompts to teach three males, ages 7, 5, and 4, with diagnoses of an autism spectrum disorder to identify class and function of various items ("What are some things you wear?" or "What are some fruits?"). The prompt was given immediately after the question was asked (errorless learning). If an incorrect response or no response occurred, the experimenter gave vocal feedback and an echoic prompt (for example, "no, say 'apple'").

Five studies (63%) compared tact interventions with another intervention. Six studies compared tact prompting with echoic prompting, one compared tact prompting with a cue-pause-point procedure, one compared tact prompting with textual prompting, and one (Luciano 1986) compared constant delay tact prompting with a modified tact prompt delay procedure. For example, Ingvarsson and Hollobaugh (2011) compared the efficiency of picture (tact) prompts with echoic prompts to teach three 4-year-old males with diagnoses of autism to identify objects by feature ("What do you sweep with?" or

"What do you use to tell time?"). Tact prompts were shown to be more efficient (fewer trials to mastery), although both prompts were effective in improving intraverbal skills. Ingvarsson and Hollobaugh (2011), along with Vedora and Conant (2015) were careful to equalize the compared interventions by eliminating any kind of additional prompt from the echoic condition, meaning the implementer did not say "say *item"* but simply said the name of the item. Furthermore, Ingvarsson and Le (2011) compared the efficiency of tact prompts with that of textual and echoic prompts to teach four males, ages 3, 5, 5, and 7 with diagnoses of autism to answer function, feature, class, and personal questions ("what do you use to tell time?" "what says 'beep beep'?" or "what state do you live in?"). The procedure was also combined with a concurrent chain procedure to evaluate client preference. Although all prompts were effective, echoic prompting was the most efficient showed fewest trials to mastery in the first phase, but the results were less conclusive in the concurrent chaining phase. Furthermore, one participant showed a clear preference for the tact prompt in the concurrent chaining phase, but the other three showed no preference.

Independent Variables

The type of intraverbal measured as the independent variable varied across the seven studies. Five (63%) of the studies measured feature ("what says moo?"). Five (63%) of the studies measured function ("what do you use to sweep?"). Six (75%) measured class ("what are four animals?"). One measured answers to personal questions, such as "what state do you live in?"

Five (63%) of the studies measured multiple intraverbal types. For example, Goldsmith et al. (2007), measured class ("what are some fruits?") and function ("what are things you wear?").

Study Outcomes

Effectiveness of Treatment

All of the studies reported overall improvement in the targeted intraverbal skills. Kodak et al. (2012) compared tact prompts, echoic prompts, and cue-pause-point training to teach two males, ages 4 and 5, with diagnoses of autism to answer questions about function. The results showed inconsistent improvement across all techniques and all participants.

Generalization

Generalization tests evaluate if a learner's ability to emit a target behavior persists in a setting or in a stimulus presentation without direct teaching (Cooper et al., 2007). Three of the eighth studies (38%) measured for generalization. Of those three, two (67%) reported overall positive generalization. Goldsmith et al. (2007) used a tact prompt in a transfer of stimulus type of procedure to teach three males ages 7, 5, and 4 with diagnoses of autism spectrum disorders to name items by class ("what are some things you wear?"). The intervention was implemented by an experimenter in the participants' homes or a university. The results showed positive improvement across all participants. Generalization to another untaught control category (types of furniture) was probed, but it did not occur.

Ingvarsson and Hollobaugh (2011) compared picture (tact) prompts with echoic prompts to teach three 4-year-old males with diagnoses of autism to answer questions about function, feature, and class ("what do you sweep with?" or "what is ice made of?"). The intervention was implemented by an experimenter in a classroom-type room at a university. Results showed positive improvement. Generalization results showed that 4 of 5 taught responses generalized to the participants' regular classroom teacher when implemented in the every-day classroom.

Maintenance

Maintenance tests evaluate if a learner persists in performing a targeted behavior once all or a portion of the intervention has been withdrawn (Cooper et al., 2007). Of the 8 studies, 50% (n=4) tested for maintenance. One reported that responses were positively maintained. Luciano (1986) used tact prompting to teach one male, age 3, with a diagnosis of cerebral palsy and two females, ages 15 and 16 with diagnoses of Cockayne syndrome and cerebral palsy, respectively, to answer questions of class and feature. All participants improved, although the experimenters noted results were somewhat mixed in some categories for some participants. The experimenter tested for maintenance one month after intervention concluded. Maintenance probes were only conducted with two of the participants because of scheduling conflicts, and reported overall maintenance of trained responses, although some correct responses decreased in one category ("clothes") across both participants. Vedora and Conant (2015) used tact, text, and echoic prompting to teach two males, ages 21 and 22, and one female, age 19, with diagnoses of autism to answer questions about function, feature, and class. Two participants were tested for maintenance. Participant A maintained responses in between 90-100% two and six

months after treatment ended. Participant B maintained response in between 80-100% two months after treatment ended.

One study reported mixed maintenance results. Ingvarsson and Le (2011) compared the efficiency of tact prompts with that of textual and echoic prompts to teach four males, ages 3, 5, 5, and 7 with diagnoses of autism to answer function, feature, class, and personal questions. Results showed positive improvement. Maintenance was probed for three of the four participants after 18 and 14 weeks for one participant, 8 and 12 weeks for a second participant, and 5 and 9 weeks for a third participant. Some taught responses were maintained by two of the participants (4 of 5 responses correct), but were low for the third (1 of 5 responses correct).

Goldsmith et al. (2007) used a tact prompt in a transfer of stimulus type of procedure to teach three males ages 7, 5, and 4 with diagnoses of autism spectrum disorders to name items by class. All participants improved. Maintenance probes were conducted at seven weeks post-intervention for one participant and nine weeks for another participant. The final participant did not participate due to scheduling errors. The authors reported that the number of correct responses was significantly lower than in intervention, and thus concluded maintenance had not occurred.

Discussion and Conclusions

63% (*n*=5) of the identified articles compared tact prompting (administered in a transfer of stimulus procedure) to other types of prompting. 80% (*n*=4) of those comparative studies compared tact prompts to echoic prompts. Across the five comparative studies, 80% (*n*=4) showed both prompt styles to be similarly effective in general, but neither style of prompting was consistently shown to be the most efficient.

The efficiency of each prompt type was determined by comparing the number of trials to mastery for each type.

Ingvarsson and Hollobaugh (2011) found tact prompts to be more efficient. However, Ingvarsson and Le (2011) found echoic prompts to be more efficient when participants were not in a concurrent chaining phase, but there was no differentiation when the concurrent chaining phase was in place. Kodak et al. (2012) showed mixed efficiency results, while Luciano (1986) found that there was no differentiation in efficiency between tact prompting and delayed tact prompting.

No studies compared tact prompting to tact training. Furthermore, tact prompting was more heavily represented in the identified articles than tact training. 75% (*n*=6) used tact prompting as the tact intervention, while only 25% (*n*=2) used tact training as the tact intervention. However, the results of the two studies that utilized tact training (Grannan & Rehfeldt, 2012; May et al., 2013) were positive across all participants.

While many have argued that individuals with ASD tend to benefit most from visual supports, the research shows mixed results when different supports are compared (Quill, 1997; West, 2008; Vedora & Conant, 2015). It is possible that prompting efficiency and effectiveness could be a result of idiosyncratic preferences and learning patterns (Ingvarsson & Le, 2011; Vedora & Conant, 2015). More research needs to be carried out in order to explore this possibility. Specifically, the results of this literature review show that more research needs to be conducted to evaluate the effectiveness of tact training as a means to teach intraverbal responses. The effectiveness and efficiency of tact prompting and tact training need to be comparatively investigated. A comparative study focusing on both tact interventions and echoic prompting could also be beneficial.

CHAPTER THREE

Method

Experimental Design

Following the design of Ingvarsson and Hollobaugh (2011), this study compared the efficiency and effectiveness of three interventions on emergent correct intraverbal responses. This study used an adapted alternating treatments design (Sindelar, Rosenberg, & Wilson, 1985). Sessions were randomly drawn to determine the order they were presented in. The dependent variable measured was correct independent intraverbal responses to intraverbal questions.

Participants

Participants were solicited from the client base at a university-affiliated clinic that provides ABA services for children with ASD. Participants needed to meet certain prerequisites in order to participate. They needed to be able to verbally communicate in at least one word phrases, have the visual ability to see an item placed at eye level approximately two feet away from them, and adequate auditory functioning to hear a verbal utterance from approximately two feet away. It was necessary for each participant to have a tact vocabulary of at least 12 words and an echoic ability to imitate words with at least two syllables.

Participants were two children who had a diagnosis of ASD. Tyler was a 14-year-old male and Adam was a 6-year-old male. Both participants communicated in full

sentences and had well-developed echoic abilities and tact repertoires. Both boys were receiving ABA therapy twice a week at the university-affiliated ABA clinic. Participants' target intraverbal questions and target responses are listed in Table 3.1.

Table 3.1

Participant	Condition	Target Questions	Target Responses
Tyler	Echoic Prompting	Name states.	Texas, Georgia, Oklahoma, Hawaii
	Tact Prompting	Name reptiles.	Lizard, turtle, alligator, rattlesnake
	Tact Training	Name flowers.	Daisy, tulip, tiger lily, sunflower
Adam	Echoic Prompting	Name body parts.	Arm, elbow, finger, knee
	Tact Prompting	Name arctic animals.	Wolf, walrus, penguin, moose
	Tact Training	Name mammals.	Bear, tiger, cheetah, monkey

Setting

Sessions for this study were held at the university-affiliated clinic where the participants usually attend ABA sessions. The sessions were conducted in the room each participant receives therapy in regularly. Each room contained a small table with chairs (for the participant, implementer, and additional observers), along with cabinets and a sink. During the sessions, participants sat at the tables across from the therapist implementing the procedure.

Materials

Laminated colored picture cards were used as both the tact training cards and the tact prompt cards for the transfer of stimulus procedure. There were two sets of four cards, one for each condition: *Tact Training* and *Tact Prompting.* There was one set of granulated laminated picture cards made for target cards in the tact prompting condition.

These pictures were made in Microsoft Word by decreasing the sharpness to -100%. Preferred items were identified by interviewing the participants' primary therapists at the clinic.

Data Collection

Data collection was performed by trained graduate students. Each session was approximately five minutes in length. Because sessions were trial based, it was not possible to determine an exact duration. Sessions ended when all 16 teaching trials and the four assessment trials had concluded. During the intraverbal assessment trials, collectors recorded responses as correct to intraverbal questions. Responses were scored as correct and independent only if they occurred within five seconds of the presentation of the question or of the prompt "what else?" (Grannan & Rehfeldt, 2012). Incorrect responses or non-target responses were scored as "other." For example, when presented with the question "name body parts," Adam emitted several non-target responses, such as "nose," "eye," and "hand." These responses were not targeted in teaching trials, and so were scored as other. See Appendix C for a sample data sheet.

Interobserver Agreement

To monitor reliability of data collection, collectors were trained on response definitions before sessions began. Collectors were taught the operational definitions of what was to be recorded as an independent response and errors (or "other" responses). Collectors also reviewed examples and non-examples with the author. Furthermore, two data collectors also independently observed and collected data on a trial-by-trial basis. An agreement for a response was scored if both observers recorded the same response

during the trial. Interobserver agreement for target responses was calculated by dividing the number of trials with exact agreement in a session by the total number of trials in a session and multiplying by 100.

Procedures

This study consisted of three instructional conditions: (a) tact training, (b) tact prompting (through transfer of stimulus control), and (c) echoic prompting (through transfer of stimulus control). Each phase had its own set of four target intraverbal responses. These target intraverbal responses were responses to questions about class (for example, "name mammals," "name body parts" or "name foods"). An intraverbal assessment was conducted at the end of each teaching session and consisted of four trials. The experimenter conducted training until the participant reached mastery criteria (75% independent across three consecutive sessions) for each teaching condition.

Pre-experimental Assessments

As in Ingvarsson and Hollobaugh (2011), an intraverbal pretest consisting of different class questions ("name sports," "name animals," "name fruits," "name instruments" etcetera) was administered. The purpose of this pre-experimental assessment was to identify class questions in which the participant could not reliably and correctly answer. Correct answers were vocally praised and incorrect answers ignored. Participants were also told "it's okay to say 'I don't know.'" Each question was administered two times to ensure the answers were not reliably and correctly emitted.

Baseline

Baseline data were collected for intraverbal responding (for example, responding to "name animals"). The number of independent correct responses was recorded. Collectors also recorded any incorrect responses as errors. A correct response was recorded if it occurred within five seconds of the question presentation. If a correct response did occur, the experimenter would prompt the participant by saying "what else?" Each question was presented two times. After presenting all three questions once, participants were given a 30-second break with access to preferred items. If a participant gave a correct answer to the question that was not a target response to be taught, the experimenter recorded it as an "error" but made a note of it in the notes section and prompted the participant by saying "what else?" For example, when asked "name flowers," Tyler sometimes said "flower." This was scored as "error," and then the experimenter prompted him "what else?"

Tact Training

The tact training procedure mimicked portions of the tact training procedures used by Grannan and Rehfeldt (2012) with modifications. Participants were taught to identify the correct class name when presented with an item that belongs to that class. For example, when presented with the question "what is a tiger?" and a picture of a tiger, participants were taught to emit "animal." A teaching session included 16 trials, four trials for each response to be taught. Responses were taught in a randomized order. A least-to-most prompting hierarchy was used. The experimenter began by presenting the question (for example, "what is a tiger?") and waiting five seconds. A partial verbal prompt (for example, "ani-" for "animal") was emitted if no response occurred. If an

error was emitted, a full verbal prompt was immediately given and repeated until the participant emitted the correct response. If no response occurred within five seconds of the partial prompt, the therapist gave a full verbal prompt ("animal") and continued to repeat it until the participant emitted the correct response. A correct response was followed by praise. This procedure continued until the participant emitted the correct responses 75% of opportunities independently (before the prompt is given) during the intraverbal assessment portion of the session across three consecutive sessions.

Intraverbal Assessment: Tact Training

After the 16 teaching trials conclude, the experimenter assessed for emergent intraverbals. The experimenter asked the student to "name *class"* (the target class for that condition; for example, "name animals"). Four trials were conducted. If the participant emitted a correct response, the experimenter prompted the participant to continue by saying "what else?" If the participant emitted a response other than those taught, the experimenter recorded the non-taught response in the "error" section and prompted the participant to continue by saying "what else?" Praise was delivered for a correct response given within five seconds of the presentation of the question or the prompt "what else?" A trial was concluded after 20 seconds if the participant continued to emit errors or non-target responses, or after the participant repeated a previously emitted target answer, or after five seconds without a response. For one participant, Adam, a ten-second break was given between each test in the assessment to help him discriminate the end of one trial and the beginning of the next trial.

Tact Prompting

In this transfer of stimulus control procedure, a different set of cards and category question were used. Target responses were presented in a random order throughout the trials, but for a total of four trials for each target. A least-to-most prompting hierarchy was used. The experimenter began by presenting the question (for example, "name animals") and waiting five seconds. A partial prompt was given if no response occurred. A partial prompt consisted of the granulated picture card of the target response. If an error was emitted, a full picture prompt and verbal prompt (presenting a picture card at 100% clarity at eye level and saying "tiger" for example) was immediately given and represented until the participant emitted the correct response. If no response occurred within five seconds of the partial prompt, the therapist gave the full picture prompt and continued to represent it until the participant emitted the correct response. A correct response was followed by praise. The therapist then prompted the participant "what else?" and immediately presented the partial prompt for the next target response. After each target response was presented once, the therapist gave the participant a preferred item or edible (as identified by the participants' primary therapists) for 30 seconds. This procedure continued until the participant emitted the correct responses 75% of opportunities independently (before the prompt was given) during the intraverbal assessment portion of the session across three consecutive sessions.

Intraverbal Assessment: Tact Prompting

After the 16 teaching trials concluded, the experimenter assessed for emergent intraverbals. The procedures were identical to those in the tact training phase.

Echoic Prompting

The echoic prompting phase was similar to the transfer of stimulus procedure used in the tact prompting phase. A third set of category questions was used. Target responses were presented in a random order throughout the trials, for a total of four trials for each target. A least-to-most prompting hierarchy was used. The experimenter began by presenting the question (for example, "name foods") and waiting five seconds. A partial verbal prompt (for example, "cra-") was emitted if no response occurred. If an error was emitted, a full verbal prompt ("cracker", for example) was immediately given and repeated until the participant emitted the correct response. If no response occurred within five seconds of the partial prompt, the therapist gave a full verbal prompt ("cracker") and continued to repeat it until the participant emitted the correct response. A correct response was followed by praise. The therapist then prompted the participant "what else?" and immediately presented the partial prompt for the next target response. After each target response was presented once, the therapist gave the participant a preferred item or edible (as identified by the participants' primary therapists) for 30 seconds. This procedure continued until the participant emitted the correct responses 75% of opportunities independently (before the prompt is given) during the intraverbal assessment portion of the session across three consecutive sessions.

Intraverbal Assessment: Echoic Prompting

After the 16 teaching trials concluded, the experimenter assessed for emergent intraverbals. The intraverbal assessment was conducted identically to those in the tact prompting and tact training procedure.

Treatment Fidelity

In order to ensure the treatment phases were implemented correctly and consistently, sessions were video recorded and reviewed or reviewed in person and evaluated for treatment integrity by a trained observer. A treatment checklist was used to evaluate the experimenters' accuracy in implementing the procedures (See Appendix B for checklist).

CHAPTER FOUR

Results

Baseline

Baseline data were taken until a stable trend in data was detected. Data were graphed on a line graph and were analyzed through visual analysis. Tyler emitted no correct intraverbal responses during baseline sessions. Adam emitted no correct intraverbal responses during baseline sessions.

Intervention

Results are shown in Graph 1 in Appendix A. Data were graphed on a line graph and were analyzed through visual analysis. Tyler reached mastery most quickly in the transfer of tact stimulus condition and the transfer of echoic stimulus condition. He reached mastery in both of these conditions in three sessions. He mastered the targets taught in the tact training condition in five sessions. Adam's results reached mastery level first in the tact training condition session. He mastered the targets in this condition in three sessions. He reached mastery in the tact transfer of stimulus condition in seven sessions. He never reached mastery in the echoic transfer of stimulus condition.

Interobserver Agreement

Interobserver agreement for target responses was calculated by dividing the number of trials with exact agreement in a session by the total number of trials in a session and multiplying by 100. Interobserver agreement was calculated for 51.25% of

sessions. The mean agreement was 92.8% (range 33%-100%). The lowest IOA score was recorded during a baseline session with Tyler. Because Tyler was emitting a large number of responses very rapidly, it was difficult to record each answer emitted. The low IOA score reflects a discrepancy between how many responses he emitted between recorders, however, it was agreed that he never emitted any correct target responses.

Treatment Fidelity

A treatment checklist was used to evaluate the experimenters' accuracy in implementing the procedures (See Appendix B for checklist). Treatment fidelity was calculated by dividing the number of steps implemented correctly by the total number of steps in the session and multiplying by 100. Treatment fidelity was calculated for 20.5% of sessions. Mean treatment fidelity was 96.8% (range 91.7%-100%).

CHAPTER FIVE

Discussion

Conclusions

In the aforementioned literature review, five studies comparing tact interventions to another intervention for producing intraverbals were identified. Of those comparative studies, 80% (n=4) showed all prompting styles used to be similarly effective in general. Furthermore, no one style of prompting was consistently shown to be the most efficient across studies. The present study is generally consistent with this trend in that no procedure proved to be the most consistently efficient across participants.

Adam mastered the target responses in the tact training condition first (in three sessions). He mastered the target responses in the tact transfer of stimulus condition in seven sessions. He never mastered the target responses in the echoic transfer of stimulus condition. Teaching ended due to the end of the summer semester; it is possible that Adam may have mastered the target responses in this condition if teaching had continued.

On the other hand, Tyler mastered responses most quickly in the tact transfer of stimulus and echoic transfer of stimulus conditions (both in three sessions). He required five sessions to master the targets in the tact training condition. It is possible that because the response in the teaching trials of this condition was identical each trial, the name of the class (e.g., “flower”), he never completely attended to the presentation of the question, prohibiting him from learning each target.

Many have argued that it is possible that prompting efficiency and effectiveness could be a result of idiosyncratic preferences and learning patterns (Ingvarsson & Le, 2011; Vedora & Conant, 2015). Learner history may affect how quickly skill acquisition occurs. While the exact learner history of the participants in this study are not known specifically, the differentiated response acquisition across conditions may suggest some type of learner preference or learner history may have been a significant factor.

Regardless of learner preference or history, it is important for individuals to be able to acquire intraverbal responses through many procedures (Ingvarsson & Le, 2011). Furthermore, as some responses may not be able to be represented visually (through a tact prompt) or may not be a response currently in a learner's tact repertoire, echoic prompting is necessary for some target skills. Furthermore, echoic prompts may be easier to implement for instructors as they require less preparation and fewer materials (Ingvarsson & Le, 2011). Because of the ease of presentation, echoic prompts could be used in the natural environment, more spontaneously, and with greater speed.

In regards to tact training, May et al. (2013) note that tact training can produce intraverbal responding through indirect teaching because the responses are a hybrid of tact and intraverbal; they occur in response to a visual stimulus in the environment ("mammal" in response to a picture card) as well as in response to the verbal stimulus ("name mammals," for example; May et. al 2013). Grannan and Rehfeldt (2012) also suggest that the effectiveness of tact training may lead to the relevance of Horne and Lowe's (1996) naming hypothesis. The naming hypothesis suggests that through listener behavior and echoic behavior, children learn bidirectional relationships between

categories and their own verbal behavior. Then through naming, this verbal behavior extends to other verbal operant classes (Horne & Lowe, 1996).

However, in regards to efficiency, tact training was the most efficient procedure for one participant (Adam). Grannan and Rehfeldt (2012) implemented similar tact training procedures as to the procedures in this study. Participants required 37 and 49 presentations of intraverbal probes before showing independent intraverbal responding. Considering the expense of ABA therapy as well as therapists' goals of maximizing the effectiveness of clients' time and energy, tact training may not be the most efficient option for some children.

Overall, the tact transfer of stimulus procedure was the most efficient procedure across participants. This procedure has been widely established in the literature as an effective way to teach children with developmental disabilities intraverbals (Goldsmith et al., 2007; Ingvarsson & Hollobaugh, 2011; Ingvarsson & Le, 2011; Luciano, 1986; Vedora & Conant, 2015). The existing literature does not show a consistent procedure as the most efficient, but the transfer of tact stimulus procedure appears to be one of the most reliably efficient and effective, although perhaps not the most efficient for all children.

Limitations

Two previous studies that utilized tact training as an intervention for producing intraverbals, Grannan and Rehfeldt (2012) and May et al. (2013) both reported few or no errors and non-target responses during intraverbal assessments. However, the most prominent limitation in the present study was that both Adam and Tyler emitted several errors during both intraverbal assessments and teaching trials. Both Tyler and Adam at

times emitted non-targeted words, or repeated responses if prompted "what else?" during intraverbal assessments. It is possible that it was unclear to the participants when the assessment trial ended and the next began, thus causing them to emit other non-target responses in response to "what else?" or the initial prompt rather than target responses they had emitted in the previous trial.

Tyler most frequently emitted errors in the tact training condition. Anecdotally, these errors largely sounded like approximations of one of the target words. This target, "tulip," was only emitted correctly once during an intraverbal assessment. However, he emitted the other three target responses reliably. As previously discussed, this could possibly have been because of the lack of equivalence of the required response in the preceding teaching trials (in which he was required to emit the category name, e.g. "flower") and the target response in the intraverbal assessment (the category items, e.g., "daisy, tiger lily, sunflower"). It is also possible that the target responses were more challenging or less known to Tyler than the target responses in the other categories.

Adam's errors were most frequently emitted in the echoic condition. Notably, this is the condition he never mastered. Although Adam emitted no responses during baseline or the pre-experimental probes (for a total of eight presentations of the question), Adam began to emit several relevant non-targeted responses as intervention continued (for example, "head, shoulders, knees, toes" in response to "name body parts"). It is possible that the presentation of multiple responses (teaching multiple exemplars) to the intraverbal question created a spillover effect, leading Adam to generalize across responses already within his existing tact repertoire. It is also possible that differentiated

responding occurred in treatment because no contingencies were in place during baseline or the pre-experimental testing, thus lowering Adam's motivation to respond accordingly.

Furthermore, Adam also would emit verbal noncompliance (e.g. "no!" "I don't want to!") during the intraverbal assessment portion of the intervention. It is of note that these responses were in fact intraverbal utterances, but not the targeted responses. Once the next trial in the assessment began, however, he usually would begin to emit the targeted responses again. It also became clear he did not always recognize that the new presentation of the prompt in a new trial ("name mammals," for example) signaled he was required to repeat the previously emitted target responses. A variation of procedures were tried to limit non-compliance and more clearly delineate the beginning of a new trial; at times he was given a 10-second break between trials, and in one session a 30-second break between trials. Beginning with session 13, he was consistently given a 10-second break between trials.

Future Research

Verbal communication is a crucial skill for children to learn. Therapists must use their time as efficiently and effectively as possible. Knowing the most appropriate manner for teaching verbal communication for each learner is undoubtedly imperative. Further research must be conducted to identify how to best evaluate a learner's most effective (or even preferred) method of skill acquisition.

As May et al. (2013) suggest, it is necessary to develop prompting procedures that create generalizable and flexible verbal repertoires, so that learners can emit proper responses both in training and across multiple appropriate verbal (and visual) prompts. Furthermore, more research clearly isolating learner history's effect on acquisition may

aide in understanding how large an impact (assuming there is one) past history has on a learner's ability to acquire new skills. This would be significant information to know for therapists working with students; knowing how students have learned in the past may inform how therapists use teaching time.

Additionally, the ability to simultaneously learn a tact response and intraverbal response should be evaluated. The participants in this study knew the tact responses previously (as determined by pre-testing), thus facilitating the transfer-of-stimulus procedures' effectiveness. If it were possible to simultaneously teach a tact response (particularly via echoic prompts) and a corresponding intraverbal response to a question, this could greatly enhance teaching efficiency for many individuals.

Finally, as sessions continued, one participant, Tyler, stopped looking at the tact training cards yet still responded correctly. Perhaps an echoic training procedure (for example, simply saying "what is a snake? Reptile" and having the participant echo back "reptile") might benefit some learners.

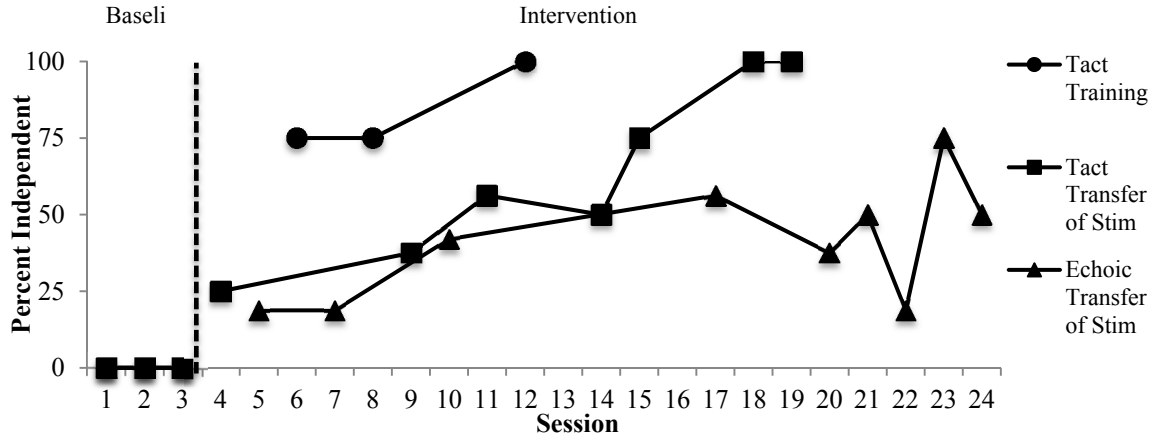
Research on the applications of Skinner's behavioral approach to language for intraverbal training, particularly for early intervention programs, has been relatively limited (May et al., 2013; Kodak, Fuchtman & Paden, 2012; Sundberg & Michael 2001). For these reasons, further investigation into the development of intraverbal behavior is of upmost importance. Cooper et al. (2007) reported that typically developing children usually exhibit a high frequency of intraverbal utterances. Engaging in intraverbal behavior allows for greater development of other verbal and nonverbal behavior, thus expanding the speaker and listener's worlds beyond what is physically present in the environment. For children with autism spectrum disorder who already experience

communicative and social deficits, this type of verbal expansion can be instrumental in development as a whole.

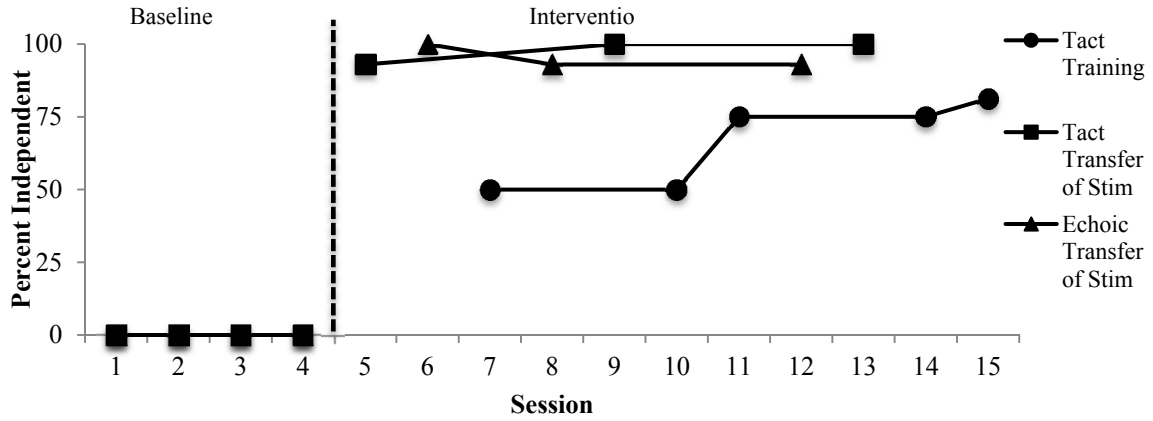
APPENDICES

APPENDIX A

Graphs



Graph 1. Intraverbal Responding for Adam



Graph 2. Intraverbal Responding for Tyler

APPENDIX B

Treatment Fidelity Checklist

Observer:_____ Date:_____
Participant:_____ Session Number:_____
Phase:_____

Item	Completion	Notes
Session occurs in participant's regular therapy room	Yes No	
Experimenter presents discriminative stimulus one time at the beginning of the trial and waits 5-sec before prompting	Yes No	
Experimenter presents the correct prompt each trial (full vocal, partial vocal, full visual, etc.) if no response occurs	Yes No	
Experimenter presents praise (and "what else" if the first three responses) upon each correct response	Yes No	
Experimenter moves to the next level of prompting if no response occurs to the first prompt	Yes No	
Experimenter records data each block ends	Yes No	
Experimenter gives edible or preferred item and a 30-sec break after block of responses ends	Yes No	
During intraverbal assessments, experimenter only presents the question once and corresponding "what else" after each answer and does not give any prompts	Yes No	
Experimenter does not give any extra prompting	Yes No	
Experimenter praises correct responses	Yes No	
Experimenter prompts "What else" after each response	Yes No	
Experimenter ends intraverbal assessment: a) after 5-sec of no response to SD or "What else" b) after 20-sec of consecutive answers c) after participant repeats non-target answers and emits no further new answers	Yes No	

APPENDIX C

Data Sheet

Participant:_____
Date:_____ Collector 1:_____
Session Number: _____ Collector 2:_____
Condition: Tact Training Tact Prompting Echoic Prompting
Targets: _____
R1 :_____ R2 :_____ R3:_____ R4:_____

Target	Independent	Prompt Required	Notes
R1	Y N		
R2	Y N		
R3	Y N		
R4	Y N		
R2	Y N		
R1	Y N		
R4	Y N		
R3	Y N		
R3	Y N		
R4	Y N		
R2	Y N		
R1	Y N		
R4	Y N		
R3	Y N		
R1	Y N		
R2	Y N		

Intraverbal Assessment

Trial	1	2	3	4
Responses				
Errors				

Participant:_____
Date:_____ Collector 1:_____
Session Number: _____ Collector 2:_____

Condition: Baseline

Target Question	Responses	Error	Notes
Q1			
Q2			
Q3			
Q2			
Q3			
Q1			

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