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THE EFFECTS OF TRANSFER TRIALS ON INDEPENDENT RESPONDING

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ABSTRACT

Errorless learning refers to a teaching methods, which eliminates or minimizes high rates of error responding. The focus of this study was to evaluate the effectiveness of the transfer trial used to transfer stimulus control of a prompted response to an independent response in errorless teaching. An alternating treatment method was used to determine which teaching condition, the transfer or no transfer, promoted the acquisition of tacts using an echoic prompt in three intermediate to advanced learners with autism. Tacts were acquired by all learners in both conditions. Error analysis was conducted in both conditions to determine the effectiveness of each. Both conditions were successful at promoting tact acquisition across learners. Each learner had different degrees of success with the no transfer and transfer condition suggesting that generalization of the results to other learners is limited. Using the transfer trial in combination with other effective teaching practices is recommended for the greatest outcomes. This study also seeks to extent research on the transfer of stimulus, errorless teaching methods, and best practices for children with autism.

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Chapter 1

Introduction

Autism Spectrum Disorder (ASD) is a complex developmental disorder that requires empirically based educational treatments implemented with fidelity. Autism is classified as one of several pervasive developmental disorders (PDD) in the American Psychiatric Association, *Diagnostic and Statistical Manual for Mental Disorders, Fourth Edition-Text Revision,* which is commonly referred to as DSM-IV-TR. The DSM-IV-TR defines the distinctive features of autism as qualitative impairment in social interaction, qualitative impairment in communication and language abilities, atypical restricted repertoire of interests and activities, and repetitive and stereotypical patterns of behavior (American Academy of Neurology [AAN], 2000). (See Appendix 1)

Autism can manifest itself in two ways, through early infantile autism, which is present at birth, and through regressive autism, which normally begins around 18 months of age. The onset of delay of the distinctive features of autism is before three years of age and affects three times as many boys as girls. There is no absolute diagnosis for autism through blood tests or brain scans; therefore, diagnosis is primarily conducted through observation of a child's behavior. Prevalence rates reported by the Center for Disease Control state that 2-6 per 1,000 (from 1 in 500 to 1 in 150) children have an ASD (National Institute of Mental Health [NIMH], 2009).

The primary goals of the treatment for autism are to minimize the central features and associated deficits of the disorder, therein maximizing functional independence and quality of life for these individuals and their families. Empirically based educational interventions, which mitigate the central features of ASD, include the use of Applied Behavioral Analysis (ABA). Applied Behavior Analysis is "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, Heron & Heward, 2007, p. 20). The incorporation of behavioral science into educational programs serves to increase and maintain desirable adaptive behaviors while decreasing and/or eliminating undesirable maladaptive behaviors, to teach new behaviors and to generalize new behaviors across new environments, people, and items. Applied behavior analysis provides a reliable and objective measure of behavior because it focuses on data derived from observable patterns of behavior and not subjective accounts of behavior. *Mental Health: A Report of the Surgeon General* states, "Thirty years of research demonstrated the efficacy of applied behavioral methods in reducing inappropriate behavior and in increasing communication, learning, and appropriate social behavior"(NIMH, 2009). These 30 years of documentation have been done through the use of single-subject research in home, school, and community programs and through controlled studies at Universities and communities in early, intensive behavioral intervention programs (Bregman, Zager & Gerdtz, 2005, Campbell, 2003, DeMyer, Hingtgen, & Jackson, 1981, Matson, Benavidez, Compton, Paclawskyj, & Baglio, 1980). Ongoing research studies show that Applied

Behavior Analysis (ABA) is effective in increasing behaviors and teaching new skills to children with autism (Goldstein, 2002; Odom et al., 2003; McConnell, 2002).

Several universal best-practices that correlate and/or enhance ABA methods described by The National Research Council (2001) are treatment beginning as soon as possible, intense treatment of at least 25 hours a week, comprehensive training, which includes curricula that address the full scope of deficits and is sensitive to developmental sequence, direct and explicit instruction in all deficit areas, prevention and reduction of behaviors, which are incompatible with learning, parent training and involvement, and ongoing and systematic progress monitoring used to inform instruction. (See Appendix 2). Treatments are designed on an individual basis due to the disorder's complexity and varying effect among individuals.

An effective teaching method for children with autism, which employs the scientific principles of ABA and the universal best practices, is intensive teaching. Intensive teaching involves the use of a well-established behavioral technology referred to as discrete trial training (DTT) (Celiberti, 2000a; Celiberti, 2000b; Koegel & Koegel, 1995; Leaf & McEachin, 1999; Lovaas, 1981; Maurice, et al., 1996). Intensive teaching, is a systematic approach to teaching and maintaining basic academic skills and is an important component of many teaching programs for children with autism.

Intensive teaching is facilitated through the presentation of errorless teaching trials sometimes also called errorless learning. (For the purpose of this paper, only the term "errorless teaching" will be used). Errorless teaching trials include the use of a prompt. A prompt is added stimuli presented before or within the discriminative stimulus

(Sd) or target behavior being taught. The prompt increases the likelihood that the learner will engage in the target behavior at the correct time at which time the target behavior can be reinforced. In short, the learner is prevented from practicing errors through the use of a prompt, which promotes faster skill acquisition in many students. When prompts are used, prompt fading procedures are necessary to prevent prompt dependency and to facilitate independent learner performance. Errorless teaching employs the use of transfer trials as a prompt fading method. The transfer trial involves fading the prompt on the trial immediately following a prompted trial. The transfer trial transfers stimulus control to an independent response.

Children with autism typically do not learn effectively through incidental exposure and consequently require repetitive practice during training. Errorless teaching provides direct and explicit instruction for relevant skills and dense practice of those skills through the presentation of errorless trials. Errorless practice leads to the student attaining increased and improved control of the environment through the development of communicative competency. To expand on effective teaching, systematic steps must also be taken to generalize skills learned in the errorless teaching process to the natural environment. Unfortunately, teachers can inadvertently promote prompt dependency through careless teaching and fading techniques, which do not allow independent responses to occur. Prompt dependency limits growth, opportunities, and active participation in school, home, and the community. Therefore, expanding the research on the effects of the transfer trial (stimulus transfer) as it relates to errorless teaching,

examining its the effects on skill acquisition and the elimination of prompt dependency serve to promote current best practices in the field of education for children with autism.

The purpose of the current study is to further expand on the importance of the transfer trial (stimulus transfer) to address the main question: What effect does the transfer trial verses no transfer trial in errorless teaching of tacts have on the rate of acquisition for children with autism? A tact is a label or name for stimuli that one contacts in his environment. (i.e. see a cat, say "cat"; hear thunder say "thunder".) This study's results may lead to increased fidelity of procedures to ensure that best practices (ABA) are being carried out with reliability. Other related questions addressed by this study are as follows: (1) How does the omission of the transfer trial affect the student's skill retention over time? (2) How does the outcome of the study affect allotted teaching time, efficiency of teaching procedures, and future teaching practices? (3) What effect does the study have on different learners based on their current operant level (early learners vs. advanced learners)? (4) Can the transfer trial have negative effects on behavior?

Chapter 2

Literature Review

Autism is an worldwide puzzle with no definitive solution. Though science continues to uncover pieces, a complete picture of the disorders etiology and a definitive treatment is yet to be seen. After examining the characteristics of autism, one begins to understand the unique qualities of each individual diagnosed with autism and why implementing educational best practices are so critical.

Autism Characteristics

Autism is a developmental disorder classified as one of several pervasive developmental disorders (PDD) in the American Psychiatric Association, *Diagnostic and Statistical Manual for Mental Disorders, Fourth Edition-Text Revision,* which is commonly referred to as DSM-IV-TR. (See Appendix 1). It defines the distinctive features of autism which include: qualitative impairment in social interaction, qualitative impairment in communication and language abilities, atypical restricted repertoire of interests and activities, and repetitive and stereotypical patterns of behavior (American Academy of Neurology [AAN], 2000). There is no absolute diagnosis for autism through blood tests or brain scans; therefore, diagnosis is primarily done through observation of a child's behavior. The onset in delay of these features is before three years of age, and it affects three times as many boys as girls. The prevalence rates reported by the Center for Disease Control is that 2-6 per 1,000 (from 1 in 500 to 1 in 150) children have an ASD. Additionally, autism can manifest

itself in two ways, through early infantile autism, which is present at birth, and through regressive autism, which normally begins around 18 months of age (National Institute of Mental Health [NIMH], 2009). Deciphering when and why neurological differences begin to emerge is indeed one of autisms most perplexing mysteries.

Diagnosis and Assessment

Diagnosis and assessment of autism is still primarily preformed through observation of the child or through exclusionary testing to rule out other disorders. By ruling out other possible causes, a stronger case for autism can be made and important early intervention procedures can begin. If symptoms of autism appear in the first few years of life, poor and atypical performances would appear at the developmental screening of well-child check-ups.

Screening can be performed through questionnaires such as the Parent Interviews for Autism (PIA), which assesses social, repetitive and sensory behaviors, and communication functions from the parents of suspect autistic children (The National Autistic Society [NAS], 2005). Parents may be asked to review their child's history by using earlier photographs and videos that might detect patterns of developmental change. Due to the complex and pervasive nature of this disorder, numerous tests for cognitive functions, social and adaptive behaviors, communication skills, as well as spontaneous or responsive play have been developed to aid in diagnosis and assessment.

The screening tests that are most widely used include the Childhood Autism Rating Scale, or CARS; the Checklist for Autism in Toddlers, or CHAT, for children aged 18 months; and the Autism Screening Questionnaire (ASQ) for children aged 4

years and older. CARS is considered a direct observation test completed by the child's parents and primary practitioner that evaluates the child's behavior. Results range from "age appropriate" to "severely abnormal" and "not autistic", "mild-moderate autistic", to "severely autistic" (NAS, 2005).

The CHAT, is a short questionnaire completed by the child's parents and primary healthcare worker, which aids in identifying at risk children for social-communication disorders upon their 18-month check-up. It covers five key areas of communication: pretend play, protodeclarative pointing, following and producing a point, and pretending (Autism Society of America [ASA], 2001).

The Autism Screening Questionnaire (ASQ) is a highly affective, 40 item screening scale that is used by the primary practitioner with children four and older to help evaluate communication skills and social functioning (AAN, 2000). Other diagnostic and assessment tests include the Autism Behavior Checklist of the Autism Screening Instrument for Educational Planning (ABC-ASIEP). It is used to indicate the existence and or severity of autistic behavior. The Gilliam Autism Rating Scale (GARS) aids in describing the percentage and or scale of behaviors such as communication and social interactions and repetitive behaviors and their frequencies. School personnel extensively use the GARS for autism assessment.

The Autism Diagnostic Observation Schedule is a format used for direct observation diagnosis. Observations of imitation, joint attention, and social routines are observed and given a definitive threshold score to diagnose autism. The Behavior Observation Scale for Autism is a checklist used for direct observation to differentiate

normal children from mentally retarded or those across the autism spectrum. The Behavior Rating Instrument for Autistic and Other Atypical Children is a diagnostic aid that assesses seven scales of development.

The Australian Scale for Aspergers reviews the abilities and behaviors of primary school age children with Asperger's Syndrome. The Pervasive Developmental Disorders Screening Test-II (PDDST-II) was created to aid parents in screening children at 18 months of age for autistic spectrum disorders. And the M-Chat tests for autism against normally developing children and is an expanded American version of the CHAT adopted from the UK (Medscape, 2009).

If parents, teachers, and health professionals spot symptoms of autism, or if a child fails any of the assessments, parents should seek out a diagnosis from a specialist in the area of autism. Diagnosis is difficult because the severity and nature of autism differs from child to child (AAN, 2000).

Once a problem is identified, a multidisciplinary team performs a comprehensive evaluation. The multidisciplinary team members may be any of the following: psychologist, neurologist, psychiatrist, speech and language therapist, occupational therapists, audiologists, social workers or other professionals trained to diagnose autism spectrum disorder. Assessments should be taken over periods of time as behaviors can vary from day-to-day and setting-to-setting with different individuals (NIMH, 2004).

Numerous tests may ensue to determine the etiology or other contributing factors. Genetic testing has revealed nervous system abnormalities and genetic defects; therefore, family history may be investigated to learn whether inherited factors may be involved.

Early occurrence of seizures may prompt the child's physician to order metabolic testing to determine any genetic or non genetic abnormalities, or an EEG to detect epilepsy due to language and or skill regression (AAN, n.d.).

Speech and Language Impairments

Communication, social and behavior impairments and deficits are the hallmark of autism. Communication encompasses both verbal and nonverbal language. Transmitting nonverbal emotions or feelings, understanding others' messages, successfully conveying one's own ideas, or simply sharing information can be a difficult task for an autistic person. Language output such as voice quality, intonation, rate, and pitch are distorted as people with autism speak in a tone of voice that lacks reflection of personal feelings. Speech tends to sound high pitched, sing song or flat and robotic, which is matched with gestures and facial expressions that rarely correspond with the context of their speech (Edwards, 2001, p. 23). People with autism also struggle to use and understand pragmatics, semantics, morphologies and syntaxes. These language and speech difficulties have a profound effect on the autistic person's ability to use language and communicate effectively. Their interpretations and use of speech serve purely instrumental functions and are not social in nature (Cohen, Dunnellon, Paul, 1987, pp. 289-293).

Nonverbal or Apraxia of speech results from neuro-motor impairments that create a disruption in the central sensory-motor processes, which interferes with the motor learning for speech (Marquardt, Dunn, & Davis, 1985). Autistic people, who only use vocal noise or indiscriminate sounds to communicate instead of words, rely solely on

these methods to express themselves. Some make the connection that a vocal "noise" can indicate a request to satisfy a need or express the desire to communicate. Unsuccessful attempts to communicate specific ideas are destined to occur, and the building frustration connected with these attempts can created undesirable behaviors (Scott, Clark, and Brady, 2000, p. 15).

Echolalia is a speech style that consists of repetitive or echoing of verbal utterances of others. This echolalic speech is common among 75 percent of people with autism and is considered "purposeful" speech either as a form of communication and/or interaction (Heffner, G. J., 2000). Echolalia is a gestalt style of speech apparent in most verbal autistics, which results from the memorization of chucks of speech, as well as visual input. Cognitive abilities and or severity of autism may play a part in speech abilities. A more analytical mind looks for meaning or interrelation of pieces of information where the gestalt mind memorizes unanalyzed blocks of information to be used in an identical way later (Cohen et al., 1987, pp. 289-293).

Literal and abstract word meanings such as idioms, sarcasms, jokes and multi-meaning words, as well as subtle changes in context confound the autistic person's comprehension abilities. This can lead to social isolation, anxiety, depression, and or behavioral outbursts. Temple Grandin, a person with autism who holds a PhD, recalls the frustration of not being able to communicate affectively, she states, "My behavior was like tripping a circuit breaker. One minute I was fine, and the next minute I was on the floor kicking and screaming like a crazed wildcat; tantrums occurred suddenly, like epileptic seizures" (Grandin, T., 1995, p. 44). Temple is one of the rare people with

autism that have succeeded in spite of her disorder becoming an Associate Professor at Colorado State University. She also has an international reputation as a professional designer of humane livestock facilities (Dr. Temple Grandin's webpage, n.d.).

Unlike Temple, nearly half of autistic children remain mute throughout their lives (Edwards, 2001, p. 22). About 70 percent are considered mentally retarded, 20 percent have normal intelligence, and about 10 percent score higher than average (Edwards, 2001, pp.16-17). Unfortunately, true intelligence levels may not be known because it is difficult to assess what the person with autism actually comprehends due to communication barriers. There are rare and remarkable people called savants that comprise 10 percent of the people diagnosed with autism (Grandin, T., 1995, p. 46). These autistic people possess exceptional talents in specific areas such as music, math or drawing (Edwards, 2001, p.17), but in turn lack utilitarian abilities in communication, social reciprocation, and self-care skills that promote independence and "complete" living. (Scott, et al., 2000, p.10).

Visual Communication Impairments

As a result of their communication impairment, people with autism rely heavily on visual processing. Unlike audio information, which requires intense attention to synchronous processing and comprehension of transitory details, visual information remains observable allowing more time for observing and comprehension to occur (Scott, et al., 2000**,** p. 10). These vivid mental pictures serve as facts and symbols that can be categorized and applied to other situations. This creates thoughts that are more associational in nature than logical. Adapting and generalizing this visual information to

different situations can be extremely difficult for autistic people with rigid behaviors and rote learning styles (Grandin, T., 1995, p. 38); while for others, visual processing can be their primary strength and method of learning (Scott, et al., 2000**,** p.10). Social interplay demands a great deal of nonverbal communication; therefore, deciphering meaning from gestures and facial expressions, eye gaze, touch, and body language creates an interpretation dilemma for people with autism **(**Scott, et al., 2000**,** p.15).

Eye contact or eye gaze plays a meaningful role in a child's developmental progress. As part of normal development, babies as young as four weeks old exchange eye contact with their mothers. Eye gaze toward a third party or object, known as triadic eye gaze, is used to assess if attention by self and another is directed toward the same action or detail. This triadic eye gaze is thought to be paramount in effective acquisiton of language. When the listener does not jointly focus on a speaker's direction of gaze, the listener may give up their attention out of confusion for the speaker's reference. Thus, deficient eye gaze or eye contact is believed to be synonymous with the manifestation of developmental disorders, in turn, contributing to or correlated with language deficits (Arnold, Semple, Beale, Fletcher-Flinn, 2000).

Differentiating facial expressions appears to be equally difficult for people with autism. A slide series of photographed achromatic faces developed by Ekman and Friesen (1978) was used in a controlled study to test the autistic person's ability to discriminate between "happy" and "sad" facial expressions. Occasionally, a neutral expression was paired with a "happy" or "sad" expression to test the duration of gaze toward the new or changed expression. The expectation was that the child would look

longer at the newly introduced expression, therefore, providing evidence of discrimination between the two. Older, as well as younger autistic children showed no evidence for either the neutral or expressive faces signifying that they did not differentiate between facial expressions. The same study was carried out using inanimate objects in place of facial expressions. In this study, autistic children did show a preference and ability in differentiating between the novel objects' category showing a preference toward objects instead of facial expressions. In a different control study, autistic children were tested to determine whether they attend to the eyes or lower part of the face to recognize emotional expression. They favored the lower part of the face with the possible belief that their focus could be derived from their failure at perspective taking, a social disinterest, or language impairments. It may also be possible that impairments in social learning could derive from limitations in facial search patterns or other social stimuli (Cohen J.C., et al., 1987, pp.114-115).

Social Communication Impairments

As babies, autistic children begin exhibiting a lack of desire to have physical contact. They may stiffen their bodies and arch away from the body contact of others or passively accept it. When older, the child, and not another person, usually initiates interaction because direct physical contact is typically avoided. Their body movements are nominal and rigid in form, and they do not understand the utility of body language. They cannot interpret or decipher its language unless explicitly taught; even then its subtleties may continue to elude them **(**Scott, et al., 2000**,** p. 20).

As one can perceive, the communication impairments displayed by autistic children can create circumstances that are difficult to predict especially when social interaction and play are involved. Understanding turn taking, sharing, game rules, acceptable physical proximity and contact, waiting, imitation and imaginative play, proper greetings, etc., can be a formidable and terrifying task for an autistic child. Many, if not all of these abilities, have to be taught or scripted to gain generalization over social areas. Prompts and cues of social behaviors are incorporated into these teachings so that nonverbal interpretations can also be learned. Scripting conversations, listing appropriate conversational topics, realizing conversational pacing and timing (beginning and ending), and learning how to respond to confusion during social interaction can help create successful social encounters. If social acceptance is not important to the autistic person, they will lack the motivation to behave in socially acceptable ways and fail to expand their communication skills (Scott, et al., 2000, p. 22).

Educational Treatment Considerations

The US Surgeon General's Report (2001) states, "Thirty years of research demonstrated the efficacy of applied behavioral methods in reducing inappropriate behavior and in increasing communication, learning, and appropriate social behavior." In *Applied Behavior Analysis* it states the definition of applied behavior analysis as, "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, Heron & Heward, 2007, p. 20). Several universal best-practice treatments that correlate with ABA described by The

National Research Council (2001) are treatment beginning as soon as possible, intense treatment of at least 25 hours a week, comprehensive training which includes curricula that address the full scope of deficits and is sensitive to developmental sequence, direct and explicit instruction in all deficit areas, prevention and reduction of behaviors which are incompatible with learning, parent training and involvement, and ongoing and systematic progress monitoring used to inform instruction. (See Appendix 2). Due to the disorder's complexity, these ABA guidelines are applied to individualized treatments because no one treatment can be generalized across people. Once a thorough assessment is conducted, the parents and educational team develop an individualized plan for the child to teach skills in deficit areas.

Though progress is being made, the complexity of autism continues to perplex the medical community as they search for answers. Educators as well strive to provide quality instructional programs that promote best practices and current research in the field. Many continue to work patiently and painstakingly determined to develop interventions using the principles and methods of applied behavior analysis (ABA) that are shown to produce substantial benefits for many children with autism/PDD (Anderson et al., 1987; Birnbrauer & Leach, 1993; Fenske et al., 1985; Lovaas, 1987; McEachin, Smith, & Lovaas, 1993).

Applied Behavior Analysis

The founder of experimental analysis, B.F. Skinner describes behaviorism as the philosophy of the science of behavior (Skinner, 1974). Behaviorism is the theory of learning that demonstrates that behaviors are acquired through conditioning.

Conditioning of behavior occurs through interaction with the environment. According to behavioral theory, behavior can be studied in a systematic and observable manner. Applied behavior analysis (ABA) employs the systematic application of behavior science to improve socially significant behavior. Experimentation is used to define the variables responsible for the improvement in behavior (Cooper, Heron & Heward, 2007).

During experimentation emphasis is placed on the principles of operant conditioning (reinforcement and punishment), which are used to increase or decrease the likelihood that the behavior of interest will occur or not occur again in the future under similar conditions. The behavior of interest is measured by analyzing the three-term contingency known as the antecedent, behavior, and consequence conditions. Each of these conditions is manipulated by changing environmental variables. As stated above, the application of variables such as reinforcement and punishment are manipulated to effect whether behaviors increase or decrease in frequency in the consequence condition. During the antecedent condition, variables such as prompting, prompt fading, and the manipulation of motivative variables can evoke behaviors to be taught or reinforced. Techniques such as shaping, chaining, and conducting a task analyses are used to promote independence of a behavior or to expand on a current skill set (Cooper, Heron & Heward, 2007). These and many other behavioral methods are used by practitioners of ABA to aid in the scientific exploration to determine the function of a particular behavior and to introduce new behaviors though reinforcement-based learning procedures.

Sidney Bijou and Donald M. Baer were pioneers in the field of behavior analysis especially for children. They published their classic work *Child Development: A*

Systematic and Empirical Theory in 1961, which explained development from a behavioral perspective (Bijou 1996). Some others who worked or studied with Bijou at that time and who also made valuable contributions to the field were Jay Birnbrauer, Betty Hart, Ivar Lovaas, Howard Sloane, and Robert Wahler. The work of these individuals focused on the application of B.F. Skinner's science of behavior in the areas of language, mental retardation, human development, education, behavior disorders, and autism. Since 1960 they have published hundreds of behavior analytic interventions for children with autism, which has laid the foundation for the field of behavior analysis in this area today (Matson, Benavidez, Compton, Paclawskyj, and Baglio, 1996). The benefits of their work are realized in the exceptional outcomes of people with autism today.

In 1968 Baer, Wolf, and Risley wrote a seminal article outlining the dimensions of applied behavior analysis (Baer, Wolf, & Risley, 1968). They emphasized the difference between basic or non-applied research and applied research and outlined seven key dimensions of applied research. Both applied and basic research methods seek to find what controls the behavior under study. Applied research focuses on variables that effect improvement in the behavior, namely those behaviors that are socially significant. The goal is to identify the controlling variables and their functional relation (Baer, et. al.1968). This information contributes to future development of effective and humane behavior change technologies (Cooper, 2007). Applied research is typically studied in its natural setting, where as basic research is generally conducted in a laboratory setting with

human or nonhuman subjects. The goal or emphasis of basic research is to discover and explain the variables related to the fundamental principles of behavior (Baer, et. al.1968).

Even though it has been 40 years since their article was written, the seven key dimensions recommended for defining and judging the value of applied research still define the characteristics of ABA today. The seven dimensions are (1) the research must seek to improve socially significant behavior (2) the behavior targeted for change must be defined, measurable, and observable, (3) a functional relation between the manipulated events and the behavior change called experimental control must be demonstrated, (4) the details of the study must be identified to permit study replication, (5) reports of the research must be conceptually systematic, meaning interpretations of how and/or why procedures were effective in relation to the scientific principles are included, (6) an effective application of the scientific methods must demonstrates a degree of significant improvement to individual's life, (7) and the behavior change must have generality, meaning that the new behavior is durable over time, appears in other environments, and can be demonstrated with other people or stimuli (Cooper, et. al. 2007).

Critical features of ABA programs developed by Bijou, Wolf, Risley, and their colleagues have had monumental effects on the field of ABA. Wolf and Risley's approach to conducting field research has shaped generations of applied researchers. For example, the reversal and multiple-baseline single-subject designs (Risley & Wolf, 1973) improved visual analysis of data, measuring complex behaviors advanced due to the 10-second interval recording method, which included using trained observers (Hart, Allen, Buell, Harris, & Wolf, 1964). With respect to subjective measurements, Wolf evaluated

the social validity of research procedures and outcomes (Wolf, 1978) as a consideration for consumer feedback on the application of ABA services. Wolf established the Journal of Applied Analysis and together with Baer and Risley they extended their influence as the editors of the first seven volumes of the *Journal of Applied Behavior Analysis* (Baer, Wolf, Risley, 1968).

Dedication to the science of behavior by these pioneering researchers literally defined applied behavior analysis and developed models for conducting natural environment research. A few examples of their monumental work include research on the influence of adult attention on the social behavior of children (Allen, Hart, Buell, Harris, & Wolf, 1964; Harris, Johnston, Kelly, & Wolf, 1964), studies conducted with children with autism using non-aversive strategies for reducing severe and disruptive behaviors (Wolf, Risley, & Mees, 1964), shaping and reinforcement procedures established to teach functional language to children with autism (Risley & Wolf, 1967). The power of social consequences, single-subject designs, and direct observational techniques for studying important behavior in context was demonstrated simultaneously by historical studies such as these (Risley, 1997).

It is important to remember that applied behavior analysis is a set of scientific principles and guidelines and not a specific program. There are a variety of names for programs that are based on the science of ABA, such as Intensive Behavior Intervention (IBI), Applied Verbal Behavior, Discrete-Trial Training, Pivotal Response Training, and Natural Environment Training (NET). Each program employs a unique system of instruction, and each may identify different behaviors of focus, but each is based on the

science of ABA (Wallin, 2004). For the purpose of the paper an extended discussion of verbal behavior follows.

Verbal Behavior

Skinner (1957) stated that language and non-language behavior were both learned behaviors acquired, expanded, and maintained by the same types of environmental variables and principles. He explained that language had a formal property (i.e. form, structure) and that it also had a functional property involving the causes of the response. Skinner was primarily concerned with the behavior of the speaker and avoided the terms expressive and receptive language. He proposed that speaker and listener behavior had separate and different functional relations.

The 1957 publication of B.F. Skinner's book *Verbal Behavior*, Skinner refers to "verbal behavior" as "behavior reinforced through the mediation of other people (p.2)". For example, if a student says to the teacher sitting at the table, "I want that book," and the teacher hands it to the student, the student's behavior is verbal behavior. The student's verbal behavior was mediated by another person. Conversely, non-verbal behaviors are behaviors that lead to direct access to reinforcing consequences and that are not communicative because access to reinforcement are not dependent upon another person. Using the same example as above the student instead goes to a table and picks up a book. We would say that this behavior is not communicative as the action was aimed directly at the book and the consequence of obtaining the book did not require mediation from another person. Therefore, verbal behavior allows the speaker to gain access to

reinforcement through the behavior of the listener, which in turn enables the speaker to control his environment.

Verbal behavior has become synonymous with vocal behavior partly due to Skinner's use of the term verbal. In the professional field of speech pathology the term verbal behavior implies vocal abilities and non-verbal implies non-vocal. Using Skinner's definition that verbal behavior is behavior mediated by the behavior of another person means that verbal behavior occurs through communication forms such as signs, gestures, written words, augmentative communication such as PECS or digital voice output system as well as vocalizations. Therefore a non-vocal speaker can produce verbal behavior. Verbal behavior is what the speaker "does" not what the speaker "has".

Skinner (1957) identified core functional units of language called verbal operants. Four of these functional units are named the mand, tact, intraverbal, and the echoic operants. Skinner proposed that each operant is a unit of language that functions in relation to environmental variables. The mand is defined as a requesting behavior used to obtain things or information that the speaker wants. The tact is defined as behavior used to name items, action, events, etc., in the speaker's environment. The intraverbal is defined as the behavior of answering questions or engaging in conversations where the speaker's words are controlled by another's words. Echoic behavior is defined as repeating what is heard. Echoic behavior requires the speaker to be vocal unlike the other aforementioned operants.

The consequence for the tact, intraverbal, and echoic behaviors is non-specific reinforcement. For example when a child points to a dog and says "dog" (tact) the

response “you’re right that is a dog” from the listener serves as non-specific reinforcement. Acknowledgement of the identification of the dog is paired with social approval or general reinforcement. The mand is the only operant where the consequence directly benefits the speaker. The mand gets the speaker what he wants and is often the strongest form of verbal behavior because it satisfies specific reinforcement. Due to the focus of this paper, future discussion will center on the acquisition of the tact.

Skinner (1957) noted that mands and tacts develop independently from one another. If a child has strong motivation for “juice” and learns how to mand for “juice”, he may not tact “juice” in the presence of a “cup of juice” or when show a picture of “juice” and asked “what is this”. The reverse is also true. Children with autism struggle to learn and use multiple functional meanings of language. The functional independence of mands and tacts in children with developmental disabilities (Nuzzolo & Greer, 2004; Twyan, 1996) and also young children without developmental disabilities (Lamarre & Holland, 1985; Petursdottir, Carr & Michael 2005) is demonstrated in these studies. Even with intense behavioral interventions of echoic to tact or manding training procedures (Partington & Sundberg, 1998; Williams & Greer, 1993) aimed at increased language production, children will emit few verbal operants in their environments. Additionally, data demonstrates that manding does not emerge from tact and receptive training for severely language-delayed children (Shaffer, 1994).

Language underlies learning in typical children. Language skills are noticeably defective in children with autism; therefore language development is a critical component of their programming. Typically developing children are encouraged to explore their

environment through play, modeling, conversation, social interactions, etc. (Bredekamp & Copple, 1997) to expand learning opportunities. Children with autism are inclined to isolate themselves from others and their severe skill deficits hinder learning through the means of exploration. Communicative efforts toward teaching these skills often fail (Spradlin & Brady, 1999). A history of failed attempts at learning set the occasion for displaying problem behaviors, such as tantrums or aggression that serves to avoid or escape future instructional attempts. Therefore, the critical task for teachers is to enhance the child's motivation to learn to increase learning opportunities.

Before teaching can occur, a thorough assessment of the individual's functional language skills and learning level is highly recommended (Sundberg, 2008). Children with autism frequently emit verbal responses that only appear correct but are not under the same sources of control that may evoke the same verbal behavior from their typical peer. Conducting a functional analysis of verbal responses will reduce and/or eliminate rote responding and irreversible verbal repertoires being learned (Sundberg, 2008). A thorough assessment will also ensure that programming goals are not over estimated causing undue frustration for the child or over estimated wasting valuable instruction time. After the assessment is conducted an individualized program is developed and teaching can begin.

Errorless Teaching

Hundreds of research studies have validated the application of ABA to educational programs for teaching students with autism spectrum disorders (ASD) (Anderson & Romanczk, 1999; Cohen & Volkmar, 1997; Matson, Benavides, Compton,

Paclawskyj, T Baglio, 1996). An application of ABA to education takes many forms, but research provides the foundation for the generalizable statements concerning the efficacy of ABA to education. Within one-on-one instruction there is a discrete trial strategy (Lovaas, 1987, McGee, Krantz, Matson, & McClannahan, 1983) as well as strategies with time delay (Charlop & Walsh, 1986; Wolery, Ault, & Doyle, 1992).

A discrete trial is a small unit of instruction usually lasting 5-20 seconds and it is typically conducted in a one-to-one instructional setting. Every discrete trial has a distinct starting and stopping point. Its components, such as precise instructions, salient prompts, delivery of reinforcement, etc. are kept simple to maximize on the successes of the student. Depending on the treatment program, instruction may last from a few minutes to over 30-minutes with several sessions occurring throughout a day.

One specific form of discrete trial training, which is the focus of this study, is referred to as "errorless teaching". To say that a procedure is completely errorless is a bit of a misnomer. It is more correct to say that the procedure is error reducing with the goal being a near zero amount of errors. The use of prompt fading, a most-to-least prompt system, and backward chaining on the acquisition of skill sets, are some examples of procedures used within errorless teaching to prevent high rates of errors.

Errorless teaching is based on the controlled presentation of antecedent, behavior, and consequence relations. An antecedent is stimulus, an event that can be detected by one's senses, which is present in the environment immediately before a behavior occurs. Behavior is the observable action of the individual immediately following the stimulus. The consequence is the event which occurs immediately following a particular observable behavior. The presentation of an antecedent stimulus known as the discriminative stimulus (Sd) precedes each response

(behavior) and each response is followed by a reinforcing consequence. Errorless teaching is performed using a sequence of distinct trials, which involves a single response with a clearly defined antecedent (Sd), and each trial has a clearly defined beginning and ending. Each trial ends with a reinforcing consequence (reinforcement), an error correction procedure, or the delivery of the next trial. There are explicit rules established concerning instructional responses classified as correct, incorrect, and non-responses. In the typical model, a correct response is reinforced by the presentation of the next trial. Each preceding trial usually serves as reinforcement for the next trial because, analogous to a behavior chain, it functions to result in the final reinforcer which is delivered at the end of this "chain of trials". This "chain of trials" in errorless teaching is referred to as a run-through.

The sequence of trials used to produce skill acquisition during errorless teaching are named the prompt trial, the transfer trial, the distract trial, and the check trial. The transfer trial is the trial of focus for this study because it is used during errorless teaching to bring a behavior under stimulus control. A definition of each trial and a teaching sample are shown below.

Prompted trial – is a trail that includes an added cue that increases the likelihood that the student will emit the correct response. For this study the instructor will use a zero-second time delay or an immediate echoic prompt as a cue (stating the name of the target picture) as the target picture is presented. The student will then echo the name of the target picture being presented.

Trial	Teacher	Learner
While presenting the target picture		
Prompt	"What is it?" "Cat"	"Cat"

Transfer trial – is a trial that immediately follows the prompted trial but where the prompt (the name of the picture) will be omitted. Upon presentation of the target picture the instructor will state "what is it?" and then give a two-second time delay for the student to respond. The student is expected to answer with the name of the item previously echoed within the two-second time period. .

Trial	Teacher	Learner
While presenting the target picture		
Transfer	"What is it?"	"Cat"

Distract trial – is a trial where the student is asked to perform behaviors that are already mastered and in the student's repertoire. This trial creates some time between the newly introduced target being taught and the following check trial.

Trial	Teacher	Learner
Distract	"Touch your nose".	Touches nose
Distract	"Say Scooby Do"	"Scooby Do"

Check trial – is a trial that immediately follows the distract trials. In this trial the instructor presents the target picture again and will state "what is it?" and the student will be expected to respond within 2 seconds. This trial is used to check the student's retention of the target picture presented prior to the distract trials.

Trial	Teacher	Learner
While presenting the target picture		
Check	"What is it?"	"Cat"

Cooper, Heron, and Heward (2007) state that a behavior is under stimulus control when it is, "emitted more often in the presence of the discriminative stimulus than during its absence" (p. 299). Behavior comes under stimulus control when a response is emitted and reinforced in the presence of one stimulus (the discriminative stimulus) but not reinforced when the response is emitted in the presence of another stimulus (the s-delta). When the discriminative stimulus is paired with reinforcement it increases the likelihood of the behavior occurring again in the future when the similar condition is present. In summary, the transfer trial is an unprompted trial that follows a prompted trial that allows the student to practice an independent response free of prompting. Therefore, the transfer trial used during errorless teaching brings the discriminative stimulus under stimulus control.

The use of the transfer trial during errorless teaching promotes independent responses. Rather than following a set prompt level to criterion, it is preferable to use most-to-least prompting and to adjust prompting moment-to-moment according to the student's responses. Guidelines used state that for every prompted trial presented a transfer trial should immediately follow.

Transfer of Stimulus

The word transfer refers to the technical description of the "transfer of stimulus control." In other words, in the prompted trial both the environmental stimulus that controls the behavior (for example a picture of a cat) and the prompt (for example an echoic prompt "cat") precede the response (in this case, the response of the student saying "cat"). The transfer trial involves fading

the prompt (eliminating the vocal prompt "cat") on the trial immediately following a prompted trial. The transfer trial transfers stimulus control to an independent response. Transfer of stimulus control, then, involves fading stimulus and response prompts to transfer stimulus control from the prompt or supplementary stimulus to the target discriminative stimuli (Cooper et al., 2007).

Errorless procedures in which discriminative stimuli are gradually faded in and/or faded out so that stimulus control is established with a negligible amount of errors appeared in the early work of Terrance (1963). In working with pigeons, he demonstrated gradually introducing a stimulus into a field where a response to the stimulus was paired with reinforcement. The original stimulus was gradually faded as a new superimposed stimulus was gradually strengthened producing stimulus transfer in the pigeon's response. The first experimental demonstrations of transfer of stimulus control where produce by Terrance's research. Later Sidman and Stoddard (1967) taught human participants to respond to successively changing discriminative stimuli by using a form of transfer of stimulus called stimulus shaping. Stimulus transfer began to be considered as a teaching technology due to Sidman's and Stoddard's research.

Skinner (1957) stressed the significance of stimulus control throughout his account of verbal behavior. He used the examples of how individuals learn from illustrated dictionaries and memorization of poetry to demonstrate the transfer of stimulus control and its role in language acquisition. He also illustrated stimulus transfer from text to the picture as a means to acquire tacts. Unfortunately, his explanation for this phenomenon of stimulus transfer lacked empirical support as the conceptual analysis was written before data were collected. Several studies (Dymond, O'Hors, Whelan, &

O'Donovan, 2006; McPherson, Bonem, Green, & Osborne, 1984; Oah & Dickenson, 1989) have investigated Skinner's Verbal Behavior to identify links and gaps in his research. A strong foundation had been established through verbal behavior research that is still progressing today.

In discussing stimulus transfer it is also important to explain a phenomenon called stimulus block that is thought to impede language acquisition. This occurs when existing discriminative stimulus blocks the acquisition of control by new stimulus. Partington, Sundberg, Newhouse, and Spengler (2004) describe a participant's failure to acquire tacts suggesting that the verbal stimulus "what is it?" always evoked the sign "ball" regardless of the non-verbal stimulus present. The results from this study supported other research findings that suggested that the blocking of stimuli can impede the transfer of stimulus control (Glat, Gould, Stoddard, & Sidman, 1994). Few experimenters have specifically designed research in this area; therefore more empirical support is necessary for future predictions of its effect and causation.

Applied research demonstrates various transfer methods to produce stimulus control. For the purpose of this paper the emphasis will be on most-to-least prompting and a delayed prompt fade procedure as implemented in the errorless teaching model. As stated earlier, the prompt is added stimuli presented before the discriminative stimulus or target behavior being taught. The prompt increases the likelihood that the learner will engage in the target behavior at the correct time wherein the target behavior can be reinforced. In short, the learner is prevented from practicing errors through the use of a prompt, which promotes faster skill acquisition in many students.

To prompt an appropriate response one could point, say, model, physical guide, gesture, or infer the correct response by virtue of the target's location, size, or color. Prompts are stimuli that control the desired behavior, but that are not functionally related to the response. Unfortunately, students who respond appropriately when prompted, often fail to do so when the prompt is removed. Persistent dependence on stimuli not essential to the desired response can promote prompt dependence by the child. Premature removal or fading of a prompt can initiate persistent error response patterns, which prevent acquisition of the target response, namely transfer of stimulus (Sidman & Stoddard, 1966; Touchette, 1968).

A most-to-least system of prompting is used to reduce prompt dependency and to promote stimulus transfer of the natural stimuli. It begins by prompting at the level necessary to attain the target response, and then gradually fades the prompt trial-by-trial, session-by-session based on the gradual change, position, or intensity of the response of the learner (Cooper, 2007). Once correct responding occurs initiated by the prompt, the task is to maintain the correct response pattern or approximations toward the terminal response while fading prompts. A short three to five-second delay of the prompt after the presentation of the discriminative stimulus aids in fading the prompt, as it provides an opportunity for a response prior to prompting to occur (Hart & Risley, 1975; Halle, Baer, & Spradlin, 1981). If stimulus transfer for the response occurs at some approximate level, the most-to-least prompt continues to be used to support learner efforts. This process continues until transfer of stimulus occurs producing an independent, prompt free response. If the correct response occurs, it is reinforced to increase the likelihood that it

will occur again in the future. The ideal transition from prompted to unprompted responding will result in near zero or no errors. An errorless transition from instructional support to independent competence is the essential goal for the learner with autism.

Transfer of stimulus control is commonly used in educational settings to teach individuals new behaviors and/or to use behaviors under new or different stimulus conditions. Instructional approaches in ABA include applications of stimulus control procedures consistently and systematically applied and documented for over 30 years. Errorless teaching has been advocated by behavioral researchers and clinicians (Green, 2001) and supported in previous studies on verbal behavior (Luciano, 1986). Behavior analysis has made many contributions to the treatment to children with autism as well (Lovaas, 2003).

Children with autism present significant challenges to educators due to the significance and encompassing effects they incur from the disorder. As stated earlier, children with autism frequently do not acquire language under the appropriate stimulus control as that of their typical peers. This can be true even for the child with autism who demonstrates language skills at the intraverbal or conversational level. Chronological age and appearance can mislead the listener into judgments about the functionality of the child's language that do not exist. An assessment of language skills, such as Sundberg's *Verbal Behavior Milestones Assessment and Placement Program*, can guide educators in appropriate programming goals to promote functional language skills (Sundberg, 2008). Educators that neglect performing a functional language assessment risk developing appropriate programming goals. This affects future skill acquisition, effective functional

language development, and ultimately independence for the learner with autism. Autistic children who frequently respond under the wrong stimulus conditions commonly still contact reinforcement from the listener (Sundberg & Michael, 2001). Unfortunately this event perpetuates the language deficit. Goldstein (2002) emphasized the need for quality instruction and programming and that the development for comprehensive communication intervention programs for children with autism represents a major challenge. Educators must learn and transfer best practices into the classroom setting to develop critical skills for children with autism. If not "best practices" remains nothing more than an empty theoretical concept.

A Review of Stimulus Transfer to Teach Tacts Literature

A review was conducted that focused on the experimental research that evaluated transfer of stimulus methods using errorless teaching procedures for teaching tacts to children with autism. Search criteria included titles that contained the words "tact", "errorless teaching or errorless learning", "stimulus transfer", stimulus control, and/or "autism". Search engines, such as Eric and ProQuest were used and only peer reviewed journal articles were considered. Articles that involved typically developing participants were not considered since children with autism do not acquire behaviors under the same stimulus control conditions as their typical peers. Training of other verbal operants was also not considered due to their differing function and the stimulus control necessary to evoke those responses, as procedures and results may not be comparable. Title search criteria produced few relevant studies due to the specific nature of the subject area. Few studies have been conducted on transferring stimulus control between verbal operants in

children with autism (Barbera & Kubina; Drash, High, & Tudor, 1999; Partington, Sundberg, Newhouse, & Spengler, 1994; Eingenheer, 2000; and Bloh, 2008). Of the studies that existed, a further review of their abstracts determined their use for this review.

The three studies selected for review sought to evaluate the procedures used for stimulus transfer for tacts, to measure rates of acquisitions using those methods, and to determine the validity of the functional relation of the dependent and independent variables for teaching tacts. Table 4 summarizes details of the studies and treatment approaches. To increase clarity and reduce reader fatigue, the studies will be identified using the first author's name only, Barbera, Sundberg, and Bloh. All other experimenter's involved in these studies are recognized and credited for their contributions.

All participants across these studies were children with autism or autism plus some level of MR with the exception of a 21 year old adult with autism and MR. Children ranged in age from four to twelve. All participants had some vocalizations with two of the participants being signers. One student was eventually withdrawn from the study due to poor performance.

Two studies were conducted in home settings where distractions were not controlled. Contingencies in homes are different than in classroom settings, but there was no mention of this interfering with conducting the study or with outcomes. Since the focus is on the analysis of stimulus transfer and methods to produce it, the settings were irrelevant.

All experimental methods for transfer of stimulus used the errorless teaching model with most-to-least prompting, differential reinforcement, and an echoic, receptive, or intraverbal prompt to produce stimulus transfer to teach the tact. Commonly researchers produce a response controlled by a single operant. That operant is then used to transfer stimulus control to establish a different verbal operant (Finkel & Williams, 2001; LeBlanc et al., 2006).

Barbera applied a concurrent use of two transfer procedures, a receptive-to-echoic-to tact (r-e-t) and echoic-to-tact (e-t) transfer, commonly used to teach tacts to children with autism. Barbera (2005) suggests that the receptive component of the r-e-t procedure may facilitate training for children who present difficulty in responding to prompts. Bijou & Ghezzi (1999) remarked that special procedures may be necessary to teach tacts due to the tact being possible irrelevant stimuli to the child. He added that the consequence for the tact involves conditioned reinforcement, which may also be ineffective, especially when motivation to engage in other behaviors, such as self stimulation may be more valuable. Bloh also used an r-e-t and e-t transfer procedure but these were used individually in separate sessions rather than in combination to teach all tacts like that of the Barbera study.

Sundberg's participants had a history of failure acquiring tacts using standard procedures. Therefore Sundberg's procedures contrasted with the standard tact training procedure like that of Barbera and Bloh where "what is it?" with imitative prompts were used. Sundberg dropped the verbal stimulus "what is it?", and instead the name of the object was vocally presented while the nonverbal object was displayed (e.g. "sign shoe").

Table 1. Summary of Literature Stimulus Transfer of Tacts

References	Participants	Setting	Experimental design	Independent variables	Dependent variables	Duration	Generalization measures	Results
Barbera, & Kubina, 2005	7 yr (1) Autism, mild MR Vocal	Home	MBL – across stimuli (3) sets of 10 pictures	Receptive to echoic to tact prompts Most –to-least prompting Differential reinforcement	Total number correct pictures identified (30)	60 sessions	Not mentioned	Successful acquisition of all 30 tact targets
Bloh, 2008	6 yr (1) Autism, mild MR, minimal vocalizations 11-12 (3) Autism, & mild, moderate, profound MR, vocal 21 yr (1) Autism, mild MR, vocal	Home	Alternating tx, MBL - across stimuli (3) sets of 12 pictures across	Receptive to echoic to tact prompts Most –to-least prompting Differential reinforcement	Total number of correct pictures identified (36)	Session times varied for each participant from 22 days to 41 day One participant was withdrawn at session 15	Not mentioned	4 out of 5 participants acquired targets Echoic to tact transfer resulted in slightly better responding for 3 out of 5 participants. Overall no difference between treatments. One participant gained no tacts
Sundberg, Endicott, & Eigenheer, 2000	5 yr (1) Autism Limited speech, signer 4 yr (1), autism, limited vocalizations	Private school	Within subject MBL with reversal, between subjects comparison (3) sets of 2 objects	Alternated trial presentation Differential reinforcement Echoic prompt vs. intraverbal prompt (discriminative stimulus prompt - object) Pre-post probes Most to least prompting	Percent correct tacts on objects		Short duration experimenter effect for participant (2) that remediated within a few sessions Anecdotal follow-up, both participants acquired over 50 tacts and receptive discriminations	Both participants acquired tacts in both conditions doing slightly better in the intraverbal prompt condition. Participate (1) had slightly more variability

Note. MBL= multiple baseline, tx= treatment

Skinner (1957) suggested that "formal prompts" like echoic and imitative prompts have the added drawback of revealing the response form to the participant, whereas intraverbal prompts, also called thematic prompts, do not reveal the response forms. When a learner is dependent upon response-form prompts, it is possible that the intraverbal prompt may be more successful in producing stimulus transfer than the use of formal prompts. Intraverbals occur in the form of hints, clues, reminders, etc., and are verbal stimuli that evoke specific, non-echoic verbal responses. This is different from the imitative or echoic prompt because it does not model the response form. Failure to acquire tacts has been observed in children using the standard procedures (Partington, Sundberg, Newhouse, and Spengler, 1994). Therefore, using intraverbal prompts may result in more successful transfer of stimulus control to target nonverbal stimulus such as tacts. Since this requires the learner to emit a response without the exact model it could aid in reducing prompt dependency as well.

Sundberg's participant's history of failure was thought to be due to stimulus blocking. This is also related to standard procedures for teaching tacts where the presence of verbal stimuli, such as "what is it?" can serve to block transfer of stimulus control of the targeted nonverbal stimuli. Other researchers also support the theory of stimulus block effect such as Glat (1994). He found that a delayed-cue matching procedure using a printed-word to dictated-name sample failed to transfer. He explained that the student only responded to the delayed cue and not the new stimulus. For this reason Sundberg's study sought to eliminate dependence on imitative prompts to establish nonverbal stimulus control for teaching tacts. He was able to demonstrate this occurrence during

the reversal condition. The verbal prompts were reversed for each set of object targets during this condition. The targets in the standard teaching format received the intraverbal teaching format and vice versa. The participant's performance immediately deteriorated when placed in the standard format condition from the intraverbal format condition. Conversely, responses improved when the objects from the standard format condition were placed in the intraverbal format condition. Barbera and Bloh did not have reversal conditions in their research designs; therefore of the three studies Sundberg's reversal design demonstrated the strongest function relation between the independent and dependent variables.

One of Bloh's participants was withdrawn from his study due to failing to acquire any tacts after 15 days of instruction. Further analysis may warrant using an intraverbal method to establish stimulus control for this participant.

Several of the participants did not acquire effective mand skills or were limited in mand abilities prior to the studies. Research of non-vocal learner's supports the theory the mand training is the most effective and efficient start for developing a verbal repertoire (Skinner, 1957; Sundberg & Michael, 2001). This is because the consequence of the mand (specific reinforcement) directly benefits the speaker, which increases the likelihood of the behavior occurring again under similar conditions. Mand training may incorporate multiple sources of operant control for example, the mand (deprivation), tact (nonverbal stimuli), and the intraverbal (verbal stimulus of the instructor) may all be operating in the environment simultaneously. Incorporating mand training in the acquisition of tacts rather than tact only was reported to be successful by Arntzen &

Almas (2002) and could be a consideration for future experimentation. Researchers have examined procedures for concurrently teaching multiple verbal operants and propose potential benefits to establishing verbal operants under multiple sources of control (Braam & Poling, 1983; Carrol & Hesse, 1987).

Procedures across all studies were systematic. Participants were given formal language assessments prior to experimentation, dependent variables were measurable and directly linked to the independently variables for functional relations to be determined, targets were selected with specific criteria that promoted external validity, and teaching procedures were systematic and included provisions to prevent sequencing effects to promoted strong internal validity. Bloh noted the potential for sequencing effects occurring if the receptive component (r-e-t) strengthened attending repertoires affecting responding in the e-t condition of his treatment. He suggested an experimental change to control for this potential occurrence. His training method alternated every three tacts; therefore one might also argue that the fix interval alternation had the potential to promote sequencing effects as well. As previously mentioned, Sundberg's study also included a reversal, which established it as the stronger experimental design. All studies included a probe to measure the acquisition of tacts with Sundberg's also including a post-assessment occurring directly after the training. This aided in across subject analysis of procedural effects.

The Barbera and Bloh studies used the r-e-t method where the first prompt was receptive, "touch the X". Barbera's method started with an imitative point and a receptive command to "touch the X". If the student echoed the tact, an immediate

attempt to transfer stimulus to the tact was performed using the echoic prompt. If a non-response or error occurred the instructor moved back to a receptive prompt of a different item. There was a fluid movement from r-e-t and back depending on the response. Bloh's r-e-t method was similar but it was a separate method from his e-t method. In this way he was able to determine the effectiveness of the receptive component where as the Barbera method could not. Barbera did state that the receptive component became less essential as the participant became more proficient at tacting.

Bloh's study included five participants with varied repertoires compared to Barbera's study with one participant. Results of Bloh's study stated that there was no evidence that either method was more effective than the other, and that the receptive component did not seem to add value to the training for his participants. Barbera and Sundberg reported that students benefited from the methods and that all participants made gains. Bloh and Barbera continued to keep mastered tacts in maintenance throughout the study. Sundberg's reported an anecdotal follow-up after one year and found that participants no longer needed intraverbal prompt procedures, manding had increased substantially, and echoic skills, such as vocal mands and tacts improved.

It is interesting to note that Sundberg's used the intraverbal prompt in both conditions for different functions. In the intraverbal treatment it was use as a prompt in the antecedent condition and in the standard treatment it was used as a correction procedure. Using the intraverbal prompt to prevent errors was more beneficial than using it to correct errors (Terrance, 1963; Touchette, 1971).

Transfer of stimulus occurred for all but one student in these three studies and each used different methods. Sundberg and Michael (2001) noted that the failure of language development for the child with autism is commonly attributed to hypothesized internal processes rather than the analysis of the appropriate environmental controlling variables. One must ask what limitations to the approach prevented stimulus transfer from occurring for this one student. Determining efficient technologies from further research comparison studies of training responses under multiple control with fading verses training under single source of control with fading for transfer to occur show benefit. Sundberg's study demonstrated that children with autism are predisposed to stimulus over selectivity, and therefore are susceptible to stimulus block (Allen & Fuqua, 1985). Research to develop assessment tools to determine which stimulus control procedure benefits the learner could prevent instructor from establishing error response patterns that are difficult to reverse. Additionally most-to-least prompting, delay prompting, and partial prompting were shown to be effective prompt fading procedures though more empirical research is necessary.

The purpose of the current study is to further expand on the importance of the transfer trial (stimulus transfer) to address the main question: Does the use of transfer trial in errorless teaching increase the rate of tact acquisition in a child with autism? This study's results may lead to increased fidelity of procedures to ensure that best practices (ABA) are being carried out with reliability. Other related questions that may develop from this study are as follows: (1) How does the omission of the "what is it" echoic transfer trial affect the student's skill retention? (2) How does the outcome of the study

affect allotted teaching time, efficiency of teaching procedures, and future teaching practices? (3) What effect does the study have on different learners based on their current operant level (early learners vs. advanced learners)? (4) Did the study reveal a standard of assessment for the transfer of stimulus control for the students in the study that could be generalized?

Chapter 3

Methods

Training

Training of the teaching procedures for each treatment condition occurred with two staff members, the teacher and one instructional aide. The instructional aide was to be a replacement person on the event the teacher could not complete the study or was absent. Another instructional aid was trained on IOA and the fidelity check procedures but was not needed for the study.

Training sessions for the teacher and one aid covered the procedures for conducting both treatment conditions, conducting cold probes and completing data recording forms. The experimenter trained all staff using a model approach (I do, we do, you do). A mock session was performed involving scoring and completing of the paperwork, which obtained a 90% or above competency score. Further review of procedures was conducted to remediate score. The experimenter was present on subsequent days throughout the study to reviewed IOA and procedures.

Participants

All participants completed and returned the informed consent forms for Social Science Research obtained through the Pennsylvania State University Institutional Review Board. (See Appendix 3) All participants had a disability of autism. Participants

consisted of two males and one female between the ages of six and nine. All participants were non- hearing impaired with good speech intelligibility. Each participant received the Assessment of Verbal Behavior Milestones Assessment Placement Program (VB MAPP) (Sundberg, 2008). Scores on VB MAPP placed the students in the intermediate to advanced area of level two and three as follows; Participant 1 scored 105.5; Participant 2 scored 133.5; Participant 3 scored 145. Previously trained school staff conducted these assessments with assistance from the experimenter.

Setting

All of the teaching sessions occurred in the participants' classroom. Sessions were conducted in the same designated location for each participant to reduce affects that may occur from changing locations. The instructor for each participant was the teacher assigned to the classroom. Each participant was seated at the instructional table across from the teacher. Reinforcers and instructional materials were prepared and arranged prior to the participant's arrival for the session to reduce downtime and risk of evoking problem behaviors correlated with downtime. Reinforcers were delivered by the teacher during the participant's specific reinforcement period.

Reinforcer Selection

Reinforcers were determined in advance for each participant to ensure high motivation to comply with the demands during the training sessions. Each participant had a list of preferred items from different categories of edibles, activities, and tangibles.

Specific reinforcers were chosen to be used only during the study sessions. This reduced the potential for habituation or satiation of the reinforcers occurring over the course of the study. During the actual sessions, the specific reinforcer's value was kept strong by mixing and varying its presentation, as well as the way it was offered.

Procedures

Target Selection and Presentation

The teacher and experimenter collaborated in selecting three sets of two different tact picture targets (six total) for each participant. The targets chosen were unfamiliar to each participant to reduce evoking correct responses not related to the treatment procedures. Selection of the targets was also based on each participant's assessed operant level and speech articulation capability from his or her VB MAPP. For example, if the participant could not articulate the beginning "sp" sound, targets beginning with "sp" were not considered.

Targets were selected for the treatment conditions by randomly splitting three cards from the six needed per participant while the Sd (picture on the card) was not in view. Each picture was then assigned to a treatment condition and then viewed. Each set was coded for participant 1, 2, or 3 and for treatment condition "transfer" or "no transfer". The targets were recorded in a table for reference. The sets shown in table 1 were established for each participant.

Table 2. Targets selection by participant.

	Participant 1		Participant 2		Participant 3	
Card Set	**Transfer**	**No Transfer**	**Transfer**	**No Transfer**	**Transfer**	**No Transfer**
1	Beaver	Harp	Asparagus	Blender	Earwig	Maracas
2	Artichoke	Escalator	Kiwi	Cymbals	Pelican	Roach
3	Trumpet	Clarinet	Egg plant	Calculator	Sea Urchin	Wrench

Targets were presented three times during one, daily 5-min session for each condition. “Easies” (previously acquired targets) were presented in-between targets to reduce demands, therein maintaining each participant’s easy to hard ratio. A run-through is shown below.

Operant abbreviations: receptive (R) Imitation (I) Echoic (E) Tact (T) Intraverbal (IV)

- Run through 1 - R, T, reinforcement = (2 demands)
- Run through 2 - I, E, T, T reinforcement = (4 demands)
- Run through 3 - E, T R reinforcement = (3 demands)
- Run through 4 - I, R, T, E, T reinforcement = (5 demands)
- Run through 5 - I, T, reinforcement = (2 demands)
- Run through 6 - IV, E, T, reinforcement = (3 demands)

Each participant’s specific variable ratio (schedule of reinforcement) was used during his or her session. Six run throughs were used to present the Sd’s. Only “easies” were presented in run throughs 1, 3 and 5. Targets and “easies” were presented in run throughs, 2, 4, and 6. Treatments phases were randomly alternated to reduce sequencing

effects with the stipulation that a condition could not occur more than three times in succession.

Transfer Trial Condition

In this condition, on each trial that the teacher presented the target picture card the prompt, transfer, distract, check teaching sequence was implemented. One target was presented three times during the session for each condition.

Sample: Prompt, Transfer, Distract, Check teaching sequence to teach "cat"

Tact - S^D is picture of a cat

Trial	Teacher	Learner
Prompt	"What is it?" "Cat"	"Cat"
Transfer	"What is it?"	"Cat"
Distract	"Touch your nose".	Touches nose
Distract	"Say Scooby Do"	"Scooby Do"
Check	"What is it?"	"Cat"

Error correction during transfer trial condition

If the participant emitted an incorrect response on the transfer or check trial, the teacher implemented the error correction procedure using the prompt, transfer, distract, and check correction sequence again.

No Transfer Trial Condition

In this condition, on each trial that the teacher presented the target picture card, the prompt, distract, check sequence was implemented. (Omission of the transfer trial) The target was presented three times during the session.

Sample: Prompt, Distract, Check teaching sequence to teach "dog"

Tact - S^D is picture of a dog

Trial	Teacher	Learner
Prompt	"What is it?" "Dog"	"Dog"
Distract	"Touch your nose".	Touches nose
Distract	"Say Scooby Do"	"Scooby Do"
Check	"What is it?"	"Dog"

E**rror correction during the NO transfer trial condition**

If the participant emitted an incorrect response on the check trial, the teacher implemented the following error correction procedure: prompt, distract, check. (Omission of the transfer trial)

Dependent Variable (1)

Dependent variable (1) was measured as the total number of trials to acquisition for each target (picture) in each treatment condition (transfer vs. no transfer). A trial is defined as when the instructor stated "What is it (name of the picture)" in each treatment condition during a run through. A run through began when the instructor presented a sequence of discriminative stimulus that required participant responds that then resulted

the presentation of a reinforcer. The run through length directly correlated with each participant's specific schedule of reinforcement. Each participant's variable rate (VR) of reinforcement was predetermined by probing the average number of demands the participant could respond to before problem behavior occurred (non-compliance, ignoring, off task, etc.). The VR was set slightly below this number to increase opportunities for reinforcement to occur at high rates and to reduce the risk of problem behavior occurring during instruction. If a participant was not adversely affected by demands, a VR was established that provided reinforcement no higher than a VR of 10 for the purpose of reinforcement occurring during the short duration of instructional time per session.

Dependent variable (2) was the number of targets acquired in each treatment conditions. Target data was collected daily and recorded on a yes/no cold probe. The criterion for acquisition was defined as the participant obtaining three consecutive "Y's" (yeses) on a daily cold probe for each target item. Consecutive days were not affected by a participant's absence or weekends. Only the recording of an "N" (no's) on the probe signified a break in consecutive days. The "cold probe" was defined as the participant's initial exposure to the target before training occurred for that day. An answer was defined as the participant's first response upon presentation of the target Sd after the instructor stated, "what is it?" while presenting the target Sd. Correct answers were recorded as "Y" on the cold probe. The definition of a correct answer was when a response occurred within 2 seconds of the presentation of the Sd. Incorrect answers were recorded as "N" on the cold probe in the following conditions:

- No response within 2 seconds of the presentation of the Sd even if correct after 2 sec
- Incorrect answer state within 2 sec
- No response within 2 sec

Collection of the cold probe data for acquisition of the targets occurred daily upon the participant's arrival in the classroom and prior to the participant's exposure to the target Sd (picture) for the first time that day. The teacher and a participating staff had an assigned clipboard with a corresponding data recording sheet developed specifically to record the cold probed data. The assigned staff member recorded the data by circling the appropriate response code on the cold probe for each participant's target. Target criterion attained in three consecutive days was highlighted on the cold probe and the instructor followed the course of action required to begin teaching the next target for that day. (See independent variable section). IOA was conducted on the cold probe procedures for four sessions across students and was 100% for all sessions.

Fidelity

Dependent Variable Inter-observer Agreement (IOA)

On specifically determined days, inter-observer agreement (IOA) was conducted on the implementation of cold probe procedure. IOA scores were recorded on the correct data sheets per treatment condition. A score of 100% was the preferred score. Had IOA scores been below 90% more, IOA session would have occurred to increase treatment fidelity.

Dependent Variable Scoring

The number of probes scored the same between observers was the number of correct scores. Correct scores were divided by the number of incorrect scores plus correct scores and then multiplied by 100 to determine the percentage of IOA. The date and IOA score for the session were recorded on the corresponding data collection form. Inter-observer agreement was assessed for the dependent variable on all of the cold probe sessions across participants, but only four of those scores were recorded. All for IOA session scored 100% with the mean score being 100% as shown in figure 1.

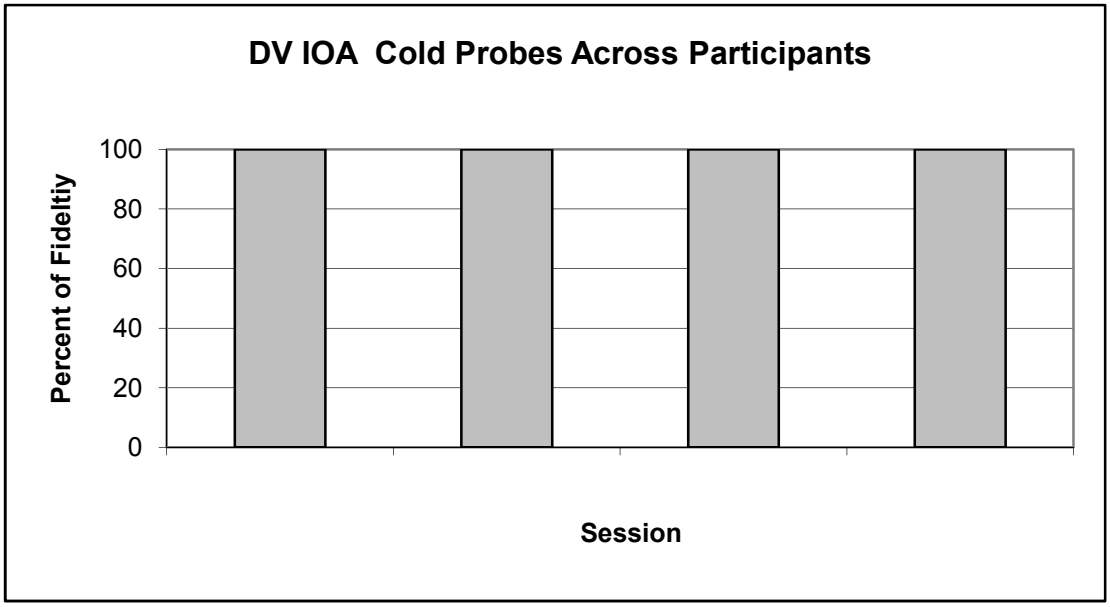

Figure 1. Inter-observer agreement mean score of 100% for cold probes across participants.

Independent Variable Procedural Fidelity

Procedural fidelity was assessed to determine the extent to which the independent variables were implemented as intended. To assess procedural integrity, teaching sessions were observed by two designated trained observers to determine the instructor's compliance with the procedures.

Independent Variable Scoring

Each observer scored a procedural fidelity check form based on the procedures to be implemented by the teacher. Observers scored their forms simultaneously for each observed treatment condition. Observers one and two compared their scores. A correct score was where observer's answers matched per question. Correct scores were divided by the number of incorrect scores plus correct scores and then multiplied by 100. This number was the percentage of fidelity for the independent variable. The score was not below 86% (6 out of 7); therefore more fidelity checks were not conducted to increase fidelity of procedures. A record of the date and fidelity check score for the session was placed on the corresponding data collection form. This data was later graphed by the experimenter. Data was obtained for randomly selected samples of 28 or 23% of the 120 treatment sessions across participants. Mean IOA score for the no transfer trial condition was 100% (see figure 2.1) and the mean score for the transfer trial condition was 100% (see figure 2.2).

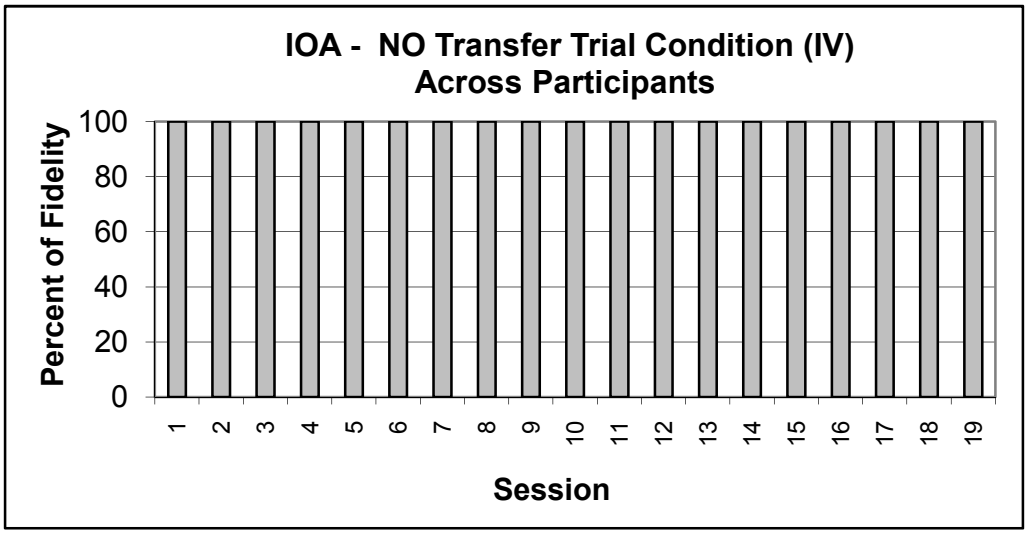

Figure 2.1. Inter-observer agreement mean scores for the no transfer conditions across participants.

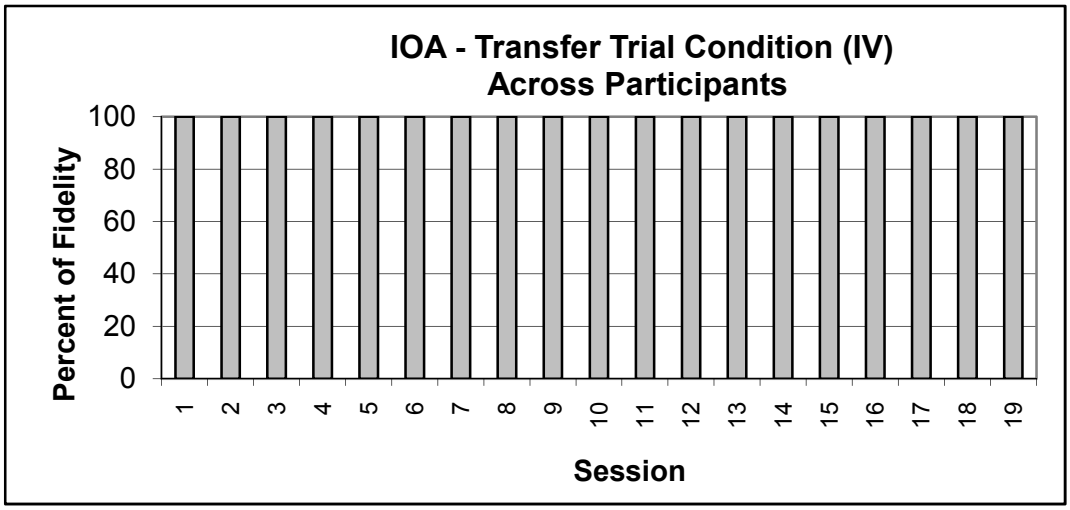

Figure 2.2. Inter-observer agreement mean scores for the transfer conditions across participants.

Maintenance

All acquired targets were kept in maintenance and presented at least twice as "easies" on a daily basis. The teacher continued with the designated error correction procedure if an error occurred on acquired targets during the maintenance phase.

Maintenance Cold Probes

These occurred two times per week on random days using the cold probe procedures describe above. If a maintenance target showed regression ("N" circled on two consecutive probes) it was to be re-taught using its designated treatment procedure. (This may signal a treatment weakness, therefore it should be documented). A phase change line would be added to the graph to show this occurrence if applicable.

Experimental Design and Analysis

An alternating treatment design for each participant was used. Baseline was determined by attaining stability of five data points at zero accuracy for each target per participant. Each participant began treatment once his or her baseline was stable. Any target in a set that did not meet criteria within 10 teaching days was to be assessed by the case study team. Assessment could include an analysis of participant responses during the teaching condition, review of the teaching procedures, and an analysis of variables such as motivation, VR schedule, reinforcers, etc. A determination would be made upon analysis on how to proceed.

Analysis

A visual analysis was conducted of changes in level, as well as trend (Kennedy, 2005). Particular attention was paid o the length of the first condition in the comparison and to the procedural differences between the two conditions. Determination of significance referred to the objective of the intervention. The experimenter analyzed whether the baseline levels maintained until the independent variable was introduced (see stability above), if the percentage of overlap of data points between the two conditions was low signaling greater impacts, and if the trend improved after the introduction of the independent variable in each condition. This occurrence was used to determine a functional relation. A replication of effect across and/or within subjects for 2 out of 3 subjects was used to signify an experimental effect. The degree of effect was determined at the time of analysis.

Chapter 4

Results and Discussion

Trials to Acquisition

All students acquired the tact targets being taught in either condition. The average number of trials to acquisition was 19.8 trials for the transfer trial condition and 18.3 trials for the no transfer condition (see figure 3). The average number of days for the target Sd to meet acquisition criteria (three yeses on the daily cold probe) was 7.4 days for the transfer trial condition and 6.3 days for the no transfer condition (see figure 4). Overall there was no significant difference between rates of acquisition between the two conditions. Table 2 shows the tact (picture) acquisition by day and by trial across participants and condition. Figure 5 and 6 show acquisition by days and trials for each participant.

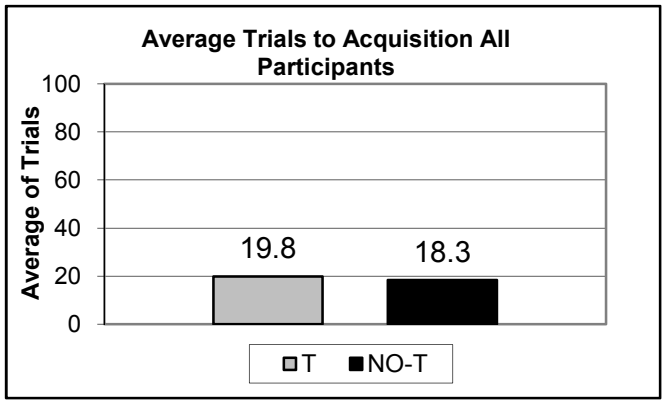

Figure 3. Trials to acquisition

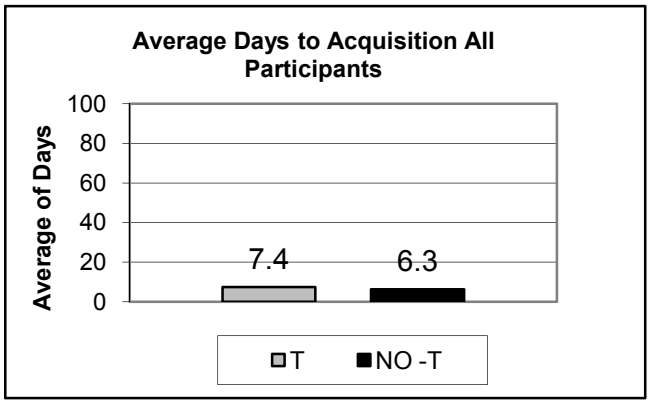

Figure 4. Days to acquisition

Table 3. Total and average tact acquisition by day and by trial for the transfer and no-transfer teaching conditions across students.

	Days to Acquisition (all cards in set)			Trials to Acquisition (all cards in set)			Average Days to Acquisition (per participant per card)		Average Trials to Acquisition (per participant per card)	
Participant	Total	T	O - T	**Total**	**T**	**O - T**	**T**	**NO -T**	T	**NO-T**
1	26	15	11	89	53	36	5	3.6	17.6	12
2	63	38	25	221	116	105	14.6	12.6	8.3	35
3	16	8	8	49	25	24	2.6	2.6	3.3	8
Average days to acquisition per participant, per card in both conditions.							7.4	6.3	19.8	18.3

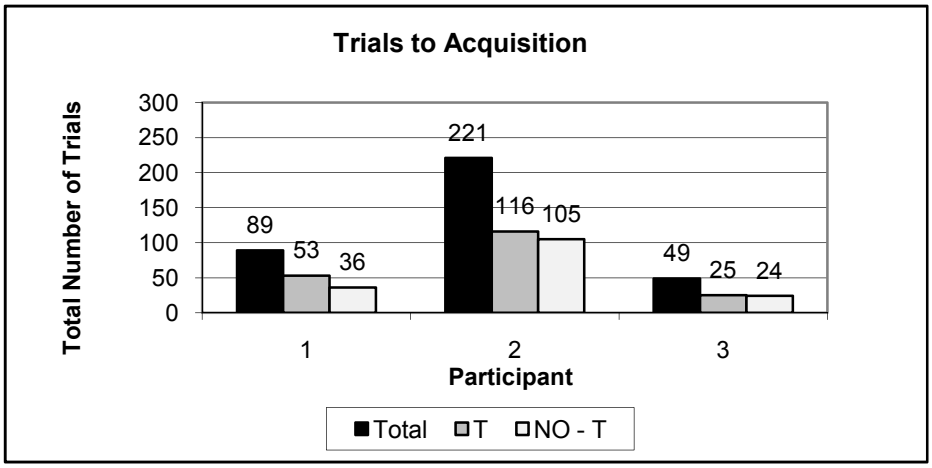

Figure 5. Trials to acquisition by participant and condition.

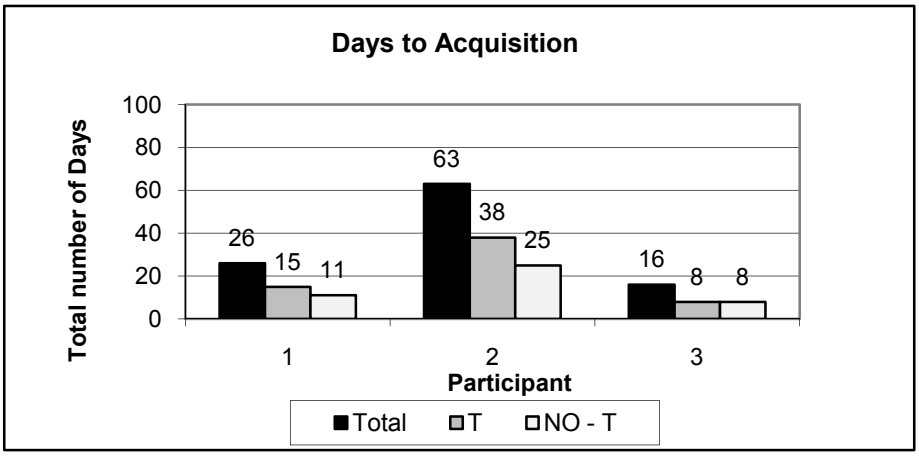

Figure 6. Days to acquisition by participant and condition.

Error Rate

Participants had an average error rate of approximately 17% across conditions with 11% of the errors occurring during the first session of a newly presented Sd across both conditions. Figure 7 shows total errors per condition across students. Participant 3 only emitted 1 error in the entire study, which was in the first session of a newly introduced target in the transfer condition making his error rate 100% for the transfer condition and (0%) in the no transfer condition. The error rate during the first session where the Sd was presented in the no transfer condition was higher for participant 2 (92%) than for participant 3 (0%) and participant 1 (50%). Figure 8 shows that error rate during the first session where the Sd was presented was the same in both conditions for participant 1 (50%). For participant 2 the transfer condition produced fewer errors at the onset of instruction. It is also interesting to note that for all participants, error rates dropped significantly after the first session where a new Sd was presented regardless of the transfer or no transfer condition. See table 3 for details on errors rates.

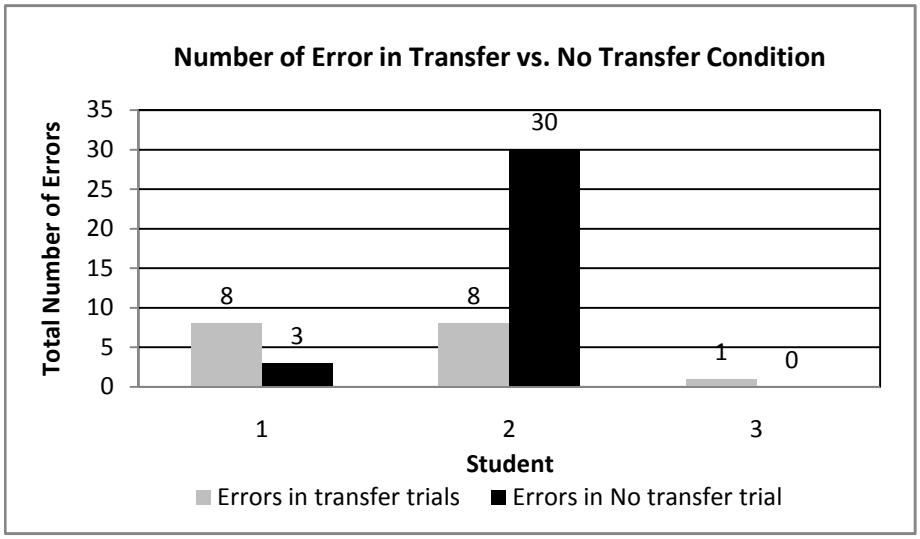

Figure 7. Total errors across participants in both conditions.

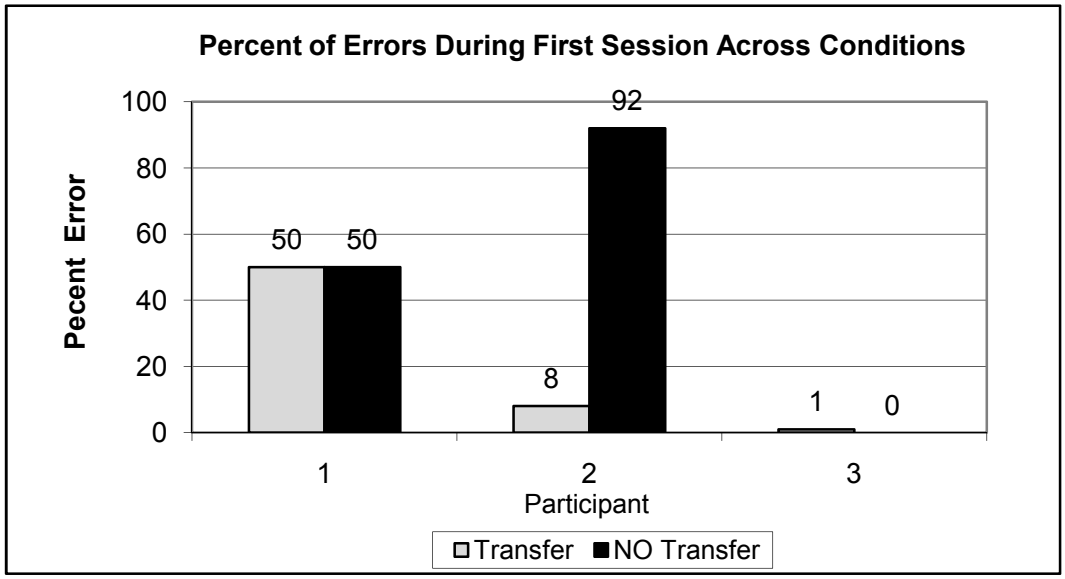

Figure 8. Percent of errors during the first session across conditions and

Table 4. Error rates across participants in both conditions.

Error Rate Comparison Table											
Participant	Total Teaching Trials	Errors in transfer trials	Errors in No transfer trial	Total Error Trials	Percent of Error	Errors during first session of newly presented Sd	Percent of errors during first session of newly presented Sd	Number of errors during the first session within procedure		Percent of errors during the first session within procedure	
								Transfer	NO Transfer	Transfer	NO Transfer
1	89	8	3	11	12%	6	55%	3	3	50%	50%
2	221	8	30	38	17%	25	83%	2	23	8%	92%
3	49	1	0	1	2%	1	100%	1	0	100%	0%

To compare acquisition rates across and within participants, each participant's cumulative date was record and graphed. Figure 9 displays data for participant 1; figure 10 displays data for participant 2; and figure 11 displays data for participant 3.

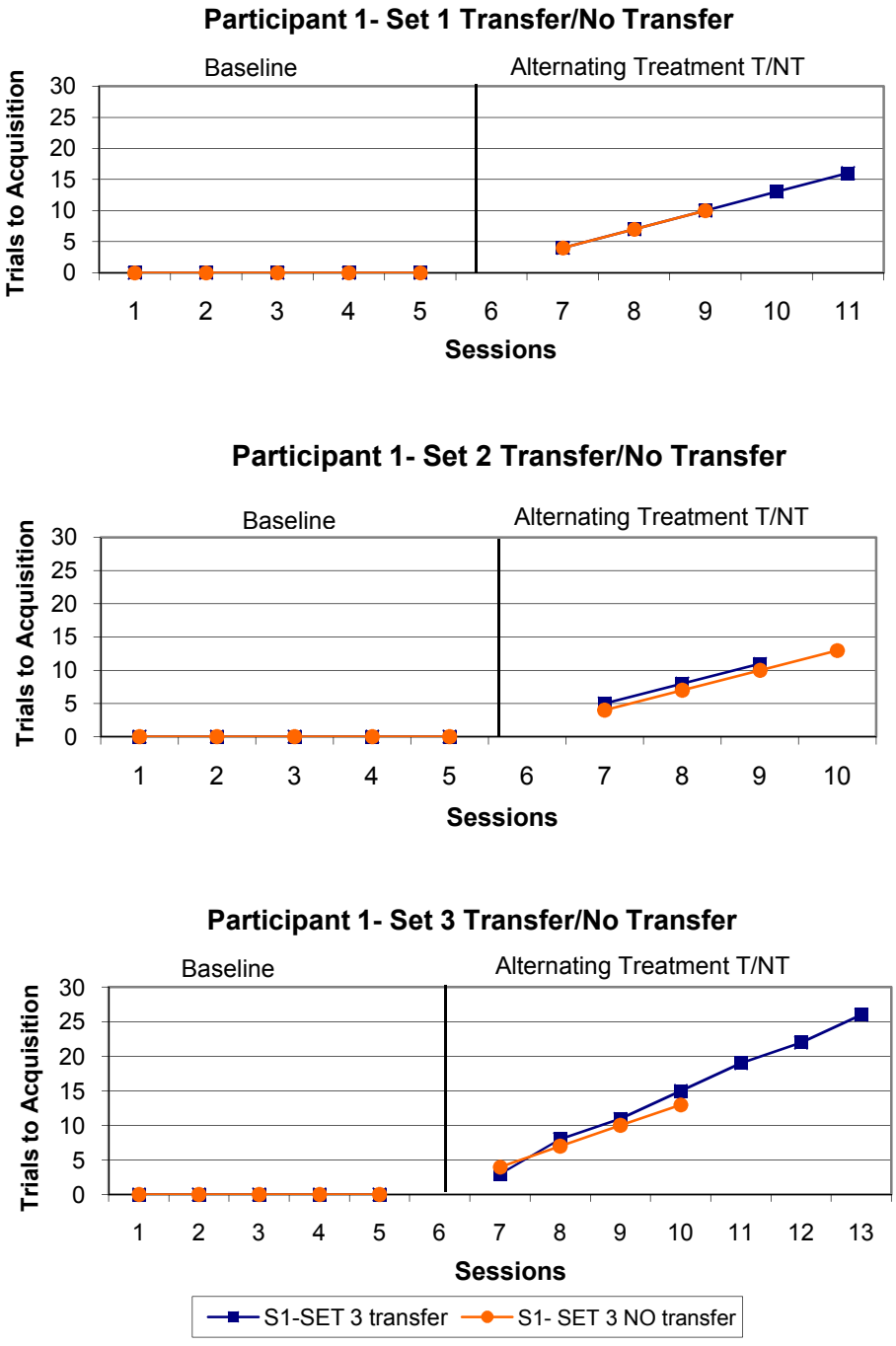

Figure 9. Alternating treatment for participant 1 across all three sets of cards.

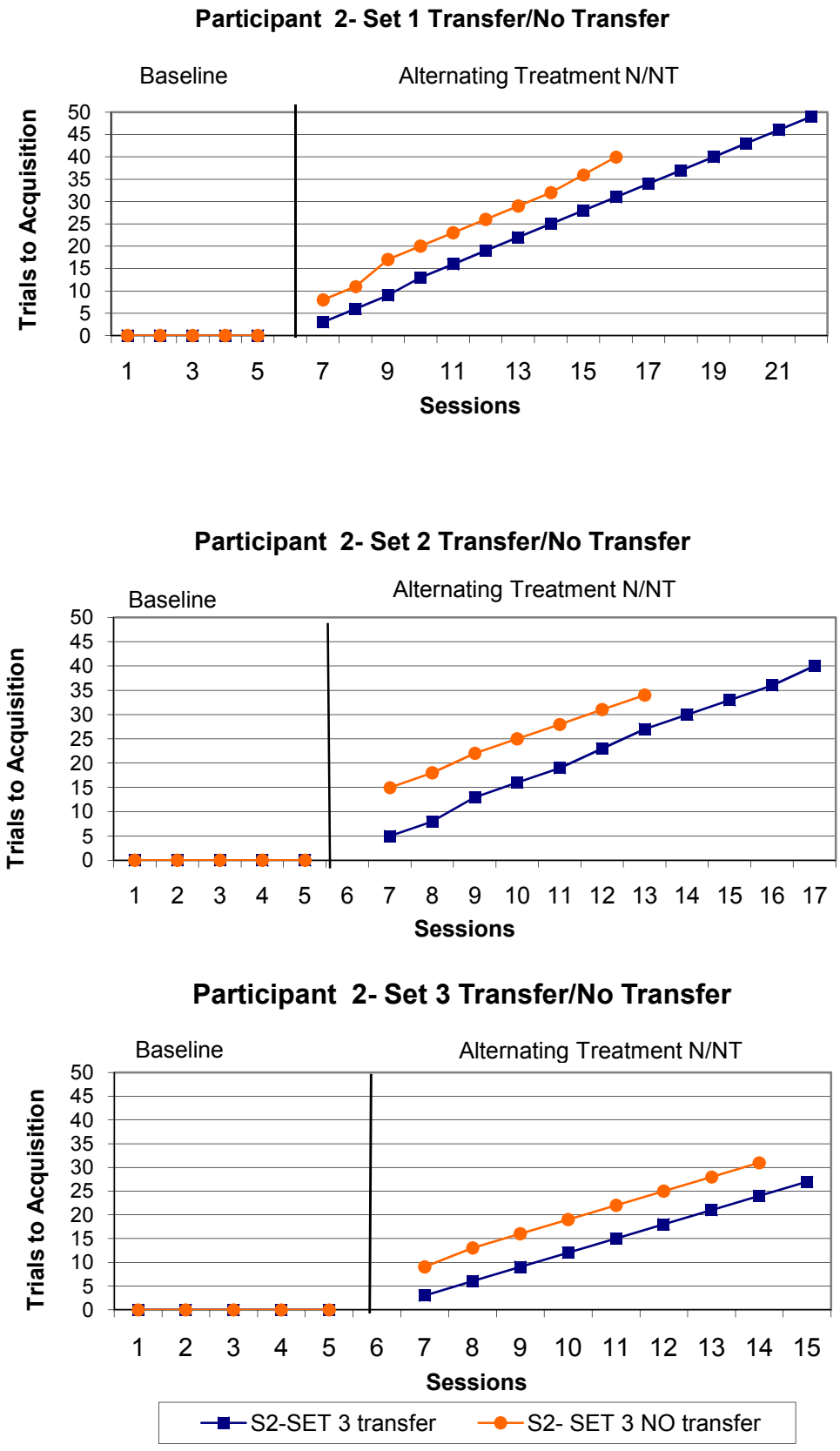

Figure 10. Alternating treatment for participant 2 across all three sets of cards.

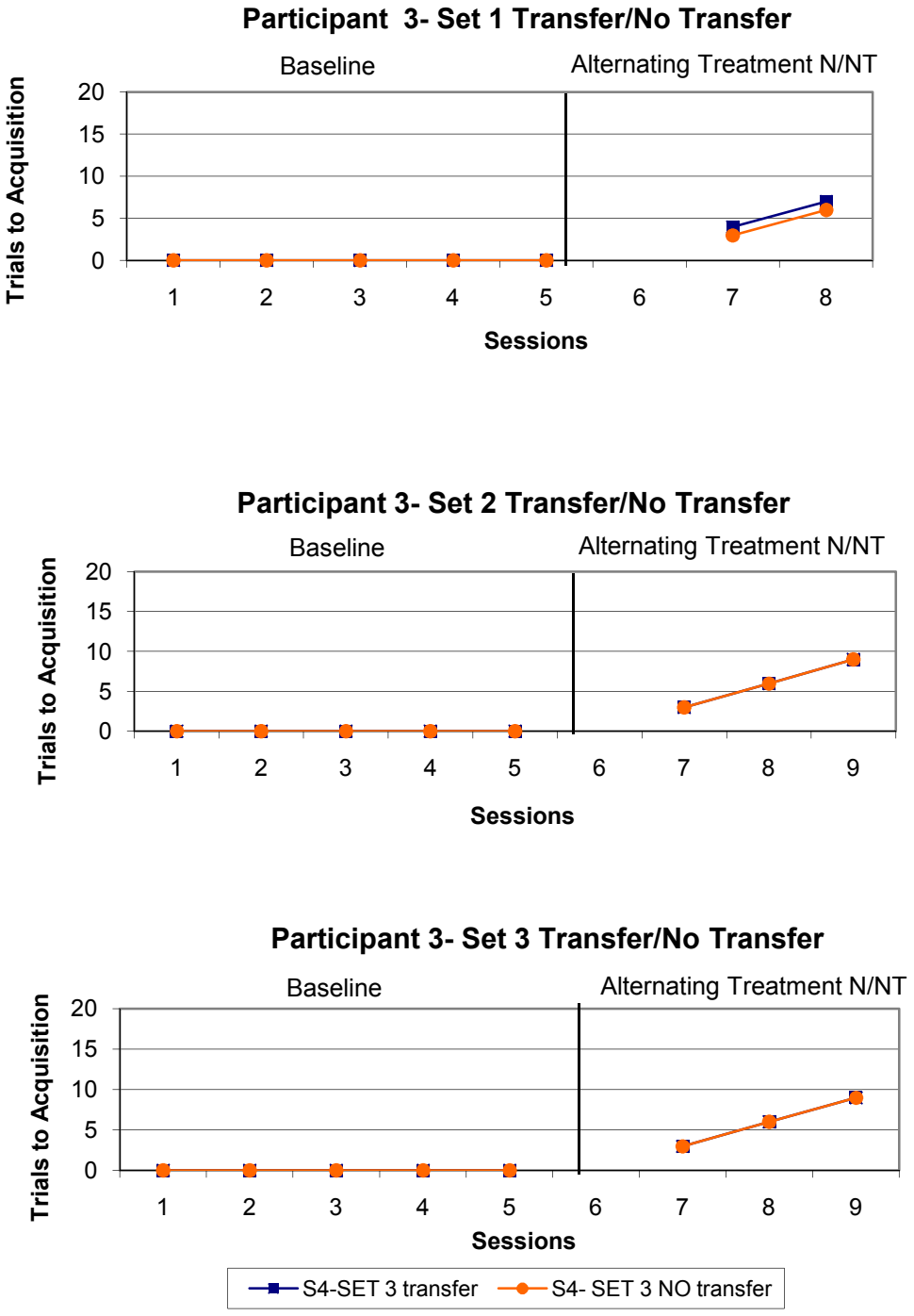

Figure 11. Alternating treatment for participant 3 across all three sets of cards.

Discussion

Participant one's total days to acquisition for all cards was 26 days. For the cards beaver, artichoke, and trumpet it took 15 days to acquire in the transfer condition and for the cards harp, escalator, and clarinet it took 11 days to acquire in the no transfer condition, which is a difference of 4 days. Total trials to acquisition for all cards were 89 trials. For the cards beaver, artichoke, and trumpet it took 53 teaching trials to acquisition in the transfer condition and 36 teaching trials to acquisition in the no transfer condition. The average days to acquisition for all cards were 5 days in the transfer condition and 3.6 days in the no transfer condition. Average teaching trials to acquisition for all cards was 17.6 teaching trials for the transfer trial and 12 teaching trials for the no transfer trial.

Due to the social reinforcer component with participant 1, using a listener responder prompt may have evoked better stimulus transfer in the transfer trial. The echoic prompt directed her attention to the instructor's face while being prompted instead of to the non-verbal stimulus (picture). This caused social reinforcement to occur (instructor looking at the instructor) during both conditions, in turn delaying responding. Directing her to the non-verbal stimulus (picture) as in a listener response prompt "touch the harp" instead of the echoic prompt "what is it, harp", could potentially reduce the social component. The no transfer trial also involved one less trial (and opportunity for social reinforcement), which may have influenced acquisition rates.

In a closer analysis of her response patterns during each condition, the transfer condition was beneficial in preventing errors from being practiced. When errors occurred

in the no transfer condition, the teaching sequence reverted back to the prompted trial. This result signals that this participant may be at risk for prompt dependency, especially when the no transfer condition is occurring. These two factors may have contributed to the equal difference (50%) between treatment condition results for participant one. Participant 1 maintained acquired targets throughout the study with no regression.

For participant 2, total days to acquisition for all cards were 63 days. For the cards asparagus, kiwi, and eggplant it took 38 days to acquire in the transfer condition and for the cards blender, cymbals and calculator it took 25 days to acquire in the no transfer condition; a difference of 13 days. Total trials to acquisition for all cards were 221. For the cards asparagus, kiwi, and eggplant it took 116 teaching trials to acquisition in the transfer condition and 105 teaching trials to acquisition for blender, cymbals and calculator in the no transfer condition. The average days to acquisition for all cards were 14.6 days in the transfer condition and 12.6 days in the no transfer condition. Average teaching trials to acquisition for all cards was 38.6 teaching trials for the transfer trial and 35 teaching trials for the no transfer trial.

Participant 2 required 50% more teaching trials to acquire targets then his peers. In the no transfer condition, he emitted an error response or no response when the transfer trial did not occur. Therefore, participant 2 was less likely to practice errors during the transfer trial. During the no transfer condition 92% of his errors occurred in the first sessions of a newly presented card compared to 8% in the no transfer condition. The echoic prompt functioned as an error correction procedure more often than a prompt. This result signals that participant 2 may be at significant risk for prompt dependency in the no

transfer condition. Unfortunately, during the transfer trial condition when participant 2 made numerous errors he began complaining when the transfer trial was presented. He stated “I know that” or “I just said that”. During error correction the transfer trial adds an additional trial that can thin the reinforcement schedule. Additionally, performing the error correction (prompt or prompt/transfer) increases the response effort. This likely evoked complaining by participant 2.

Participant 2 also began to develop a discrimination error after acquisition had occurred with eggplant and kiwi. He frequently self-corrected the picture of kiwi for eggplant. Some attributes were similar, as the kiwi was egg shaped and the eggplant had similar colors to that of the kiwi picture. Probed separately he did not error, but when the pictures were presented together he self-corrected at high rates. This is called a conditional discrimination error and it is not an uncommon occurrence. A conditional discrimination is defined as, “A discrimination in which reinforcement of responding during a stimulus depends on (is conditional on) other stimuli” (Catania, 1998, p. 382) Presenting the two acquired stimulus together, while running discrimination trials between the two pictures was recommended. The analysis on these two items revealed that the error was not due to the target being acquired since he could readily identify them in isolation. Therefore, this student has maintained all acquired targets to date.

Participant three’s total days to acquisition for all cards was 16 days. For the cards earwig, pelican, and sea urchin it took 8 days to acquire in the transfer condition and for maracas, roach, and wrench it took 8 days to acquire in the no transfer condition. There was no difference in acquisition rates between conditions. Total trials to

acquisition for all cards were 49 trials. For the cards earwig, pelican, and sea urchin it took 25 teaching trials to acquisition in the transfer condition and for the cards maracas, roach, and wrench it took 24 teaching trials to acquisition in the no transfer condition. The average days to acquisition for all cards were 2.6 days in the transfer condition and 2.6 days in the no transfer condition. Average teaching trials to acquisition for all cards was 3.3 teaching trials for the transfer trial and 8 teaching trials for the no transfer trial.

Participant 3 only emitted one error throughout the entire study, which was during the transfer trial. The error was a correct response after the two-second delay. The high rate of correct responding suggests that for participant three the transfer or no transfer condition did not have a significant effect on his responding; nor was he at risk for prompt dependency within this specific instructional condition. Participant 3 maintained the acquired cards throughout the study.

A review of participant three's responses suggests that he has acquired the necessary foundational skills to support learning without or with minimal prompts and with very few teaching trials being necessary. The transfer trial was of no significant benefit for this student. Participant 2 and 3 may be on the threshold of these abilities.

Targets in the no transfer trial condition were acquired faster within and across targets for participant 1 and 2. Therefore, replication across and within participant 1 and 2 occurred in the no transfer condition. It should be noted that it was determined that two of the three targets for participant 1 and 2 in the transfer condition did not result in high error patterns, they were just difficult items that required more teaching trials to acquire. Participant three acquired all targets simultaneously. Additionally, a careful review of

the error and response patterns of each student showed that though the transfer condition did not produce faster acquisition with all targets, it more importantly did not promote more practicing of errors as compared to the no transfer trial.

The variation in treatment results across targets suggests that the instructor assess the effectiveness of the transfer trial methods and the prompt methods being used for each individual participant. Carefully observing patterns of participant responding during instruction and reviewing the participant's VB MAPP assessment to determine the strength of the operants being used for prompting was suggested for future instruction.

Results signal the critical need for instructor's to recognize what variables or conditions impede or enhance acquisition of skills for each individual learner. Teachers should consider carefully the choice of the instructional methods and controlling prompts with consideration to the abilities and limitations of the participant with ASD. Using methods that benefit individual learners promote efficient and effective learner environments that enhance allotted teaching time.

An additional consideration for the no transfer trail participant's performing better is that advanced level participants were used for this study. Advanced learners who have acquired large repertoires in a skill area such as tacting can require fewer teaching trials and prompts for future tact target acquisition. This was definitely the case for participant 3. Also, it is possible that the transfer trial had a punishing effect due to thinning the reinforcement schedule and increasing response effort. When a sequence of errors occurs, instructors need to interrupt this pattern to avoid thinning the student's reinforcement schedule. One suggestion is to interject an easy skill into the run-through

that can be reinforced. Then continue to present easy skills until the VR can be reestablished. Once reinforcement schedules are re-established the target can be reintroduced. This maintains an easy to hard ratio that competes with escape from the task. Formal research also suggests that learning by trial and error can provoke problem behavior, which can sometimes be severe (Carr, Newsom, & Binkoff, 1980; Weeks & Gaylord-Ross, 1981). Consequently, effective instruction demands knowledge of factors that promotes the emergence of correct stimulus control during training.

Limitations

Due to the limited time available to conduct the study, additional manipulations of the independent variable were not an option. Teachers and staff implementing procedures had proficient but basic knowledge of effective teaching practices and case study design.

Future Research

As demonstrated by this study, further research examining treatments related to the isolation of intervention variables within treatment packages, such as errorless teaching would be beneficial. Applying this study across various learner levels; early, intermediate, and advanced, would likely yield different results that could guide future instruction. Other possibilities for future research include a focus on the occurrence of errors in relationship to the teaching procedures and the effects of the specific types of errors on acquisition rates, the risks of prompt dependency in relationship to the prompt

system being used, and studies with focus on individual trials to criterion verses cold probes to acquisition. Determining a standard measure for assessing the variables that evoke transfer of stimulus in a specific learner, for example, determining which prompt or prompt fade condition yields faster acquisition based on a learner's history of responding could lead faster acquisition of skills.

Conclusion

The addition of transfer trials did not result in increasing the rate of acquisition for all targets across or within students for these more advanced learners. The omission of the transfer trial did not affect the participant's skill retention over time; all skills were maintained throughout the study. The outcome of the study demonstrated that a careful review of the variables effecting each student's error and response patterns can lead to more effective teaching time, efficiency of teaching procedures, and future teaching practices for each learner. The study also demonstrated the need for instructors to examine the variables that effect each learner's acquisition, as well as implementing the best methods to promote successful outcomes. Planning instructional goals developed from a thorough assessment has also shown to have benefited the participants in this study. There is also support for the view that it is more beneficial to use prompts to prevent errors verses to correct errors (Terrance, 1963; Touchette, 1971). Promoting learner independence through errorless teaching methods had strong utility for educators of children with autism.

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Appendix A

FACT-BASED AUTISM INFORMATION
Meta-Analysis of Universal Best Practices across Autism Interventions

While Behavioral and Developmental models differ in their theoretical foundations, intervention philosophies and methodology, meta-analysis from twenty years ago, and in again in 2000 repeatedly demonstrate that effective models follow several common universal best-practices. Because eclectic models can vary widely, and cannot be validated by research as we build them for each individual person, they can greatly enhanced by, and their outcomes may even be dependent upon, the use of these universal best Autism practices for successful results. These guidelines also allow the Autism community to have some principles we can have consensus on, even as we may agree to disagree on the specific models we may choose from in a person-focused, family-centered, and community based model approach.

The following are the ten universal best-practice features that have been shown to provide a common foundation to all successful intervention programs:

1) Emphasis on earliest possible screening, diagnosis, eligibility for Autism services evaluations and ongoing assessment in the immediate implementation of appropriate effective Autism interventions;

2) Programs are tailored to the needs of each individual with specific adaptations that match the person's spectrum profile, age, stage of development, and emergent potentials;

3) Highly structured and skill-oriented teaching and treatment programs;

4) Frequent informal reassessment and systematic data-based tracking of skill growth and related plan review and revisions;

5) Use individual motivational strategies and systems (behavioral model motivators are more extrinsic in nature, and developmental model motivators are more intrinsic in nature. Most programs will utilize a certain combination);

6) Teaching areas are structured, organized and distraction-free environments which incorporate intensive one-to-one and small group sessions. Activities and routines are flexible yet predictable. Time spent waiting is kept to a minimum;

7) Provide multiple settings and consistency of methodology across time and spaces, in at least three and up to six settings, for promoting skills generalization;

8) All personnel are well-trained and continuously evaluated for competence and consistency in application of the intervention model used--optimally a family-centered choice with life-span planning;

9) Comprehensive home programming and parent training within a team approach that seeks to use the family's talent in a co-treatment model;

10) Intervention strategies are maintained full-day and year-round from preschool through adulthood, as provided by our family and respite-care providers and our public and private services and programs.

The research over the last two decades consistently shows 25 hours a week in year-round programs is the service level needed to produce positive levels of growth in the face of the effects of Autism on infants and young children. However, 40+ hours may be needed for optimum outcomes in behavioral programs that are seeking fully normative outcomes. However the entire family, respite, public or private provider team, and strong shared data tracking systems are all important parts of reaching any best practice program goals. No one member of our family or society can do this alone.

RECENT PUBLICATION: A meta-analysis of educational interventions text: "Educating Children with Autism" Published by the National Research Council. National Academy Press. Washington D.C. at: **www.nap.edu** PAST RESEARCH: COSAC/Center for Outreach and Services for the Autism Community, 1450 Parkside Avenue, Suite 22, Ewing, NJ 08638. Autism Helpline **1-800-4-AUTISM**. Basic Information/Research in English and Spanish.

Appendix B

Criteria for Autistic Disorders
The Diagnostic and Statistical Manual of Mental Disorders
DSM-IV-TR

A. A total of six (or more) items from (1), (2), and (3), with at least two from (1), and one each from (2) and (3):

1. qualitative impairment in social interaction, as manifested by at least two of the following:
    a. marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction.
    b. failure to develop peer relationships appropriate to developmental level
    c. a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest)
    d. lack of social or emotional reciprocity
2. qualitative impairments in communication as manifested by at least one of the following:
    a. delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime)
    b. in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others
    c. stereotyped and repetitive use of language or idiosyncratic language
    d. lack of varied spontaneous make-believe play or social imitative play appropriate to developmental level
3. restricted, repetitive, and stereotyped patterns of behavior, interests, and activities, as manifested by at least of one of the following:
    a. encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
    b. apparently inflexible adherence to specific, nonfunctional routines or rituals
    c. stereotyped and repetitive motor mannerisms (e.g. hand or finger flapping or twisting, or complex whole body movements)
    d. persistent preoccupation with parts of objects

B. Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years: (1) social interaction, (2) language as used in social communication, or (3) symbolic or imaginative play.

C. The disturbance is not better accounted for by Rett's Disorder or Childhood Disintegrative Disorder.

Appendix C

Informed Consent Form for Social Science Research
The Pennsylvania State University
(PARENT VERSION)

Title of Project: The Effects of Transfer Trials on Independent Responding

Principal Investigator: Linda Franchock
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1. Purpose of the Study: The purpose of this research is to examine the effects of an additional teaching trial on learning. The teaching methods examined in this study are already used in the instruction received by your child in their current classroom. The purpose of this research is to further document the effectiveness of the procedures. The results may indicate that more emphasis should be placed on one technique over the other.

2. Procedures to be followed: Your child will be asked to identify pictures using two different teaching methods. The first method that is currently used includes prompt fading procedures with an immediate practice of an independent response. The second method includes prompt fading procedures, with a delayed practice of independent responses.

3. Benefits: Your child will receive extra practice in language skills.

4. Duration/Time: Your child will be asked to participate in the study for approximately 7 hours total spread over a 3 month period. The daily duration of the session will be approximately 7 minutes per session for a 6-10 week period of time).

5. Statement of Confidentiality: Your participation in this research is confidential. The data will be stored and secured at 226 CEDAR in a locked file. Only the researchers will have access to the data. In the event of a publication or presentation resulting from the research, no personally identifiable information will be shared. The Pennsylvania State University's Office for Research Protections and Institutional Review Board, and the Office for Human Research Protections in the Department of Health and Human Services may review records related to this project.

6. Right to Ask Questions: Please contact David Lee at (814) 865-3567 with questions, complaints or concerns about this research. You can also call this number if you feel this study has harmed your child. If you have any questions, concerns, problems about your rights as a research participant or would like to offer input, please contact The Pennsylvania State University's Office for Research Protections (ORP) at (814) 865-1775. The ORP cannot answer questions about research procedures. Questions about research procedures can be answered by the research team.

7. Voluntary Participation: Your decision to allow your child's participation in this research is voluntary. You can stop at any time. You or your child does not have to answer any questions you/your child does not want to answer. There are no reasonably foreseeable discomforts or risks of participating in the study. Refusal to take part in or withdrawing from this study will involve no penalty or loss of benefits you/your child would receive otherwise.

____I agree to allow the total number of skills learned from this research examining the effects of an additional teaching trial on learning to be released to the principal investigator and the research team of this study for the purpose of evaluating the effects of transfer trials on learning.

____I DO NOT agree to allow total number of skills learned from this research examining the effects of an additional teaching trial on learning to be released to the principal investigator and the research team of this study.
If you agree to allow your child to take part in this research study and the information outlined above, please complete the information below.

I give permission for my child, _____, to participate in this research.

You will be given a copy of this consent form for your records.

_____ _____
Parent Signature Date

_____ _____
Person Obtaining Consent Date