ABSTRACT

An Evaluation of Generalization Strategies Used with
Functional Communication Training

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Research has shown that functional communication training (FCT) is effective for reducing problem behavior and multiple schedules can facilitate reinforcer schedule thinning during FCT. Most studies that have used multiple schedules with FCT have included contrived stimuli (e.g., colored cards) as the discriminative stimuli (S^Ds), but recently, researchers have evaluated similar multiple-schedule training procedures with naturally occurring S^Ds (e.g., activities or items that signal reinforcement in the natural environment). The purpose of the current study was to evaluate the effect of discrimination training and fading from contrived to natural stimuli on the generalization of the communicative response to untrained natural stimuli.

An Evaluation of Generalization Strategies Used with Functional Communication Training

by

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CHAPTER ONE

Introduction

Applied Behavioral Analysis

Applied Behavior Analysis (ABA) is the scientific approach for discovering variables in the environment that reliably influence socially significant behavior and developing a technology for behavior change related to those discoveries (Cooper et al., 2007). There are three levels of scientific understanding which contribute to a given field: description, prediction, and control. Enabling scientists to describe a given phenomenon accurately improves one's ability of understanding, this is categorized as description (Cooper et al., 2007). Prediction is the second level of scientific understanding. Prediction occurs when a correlation between two events is observed repeatedly. Lastly, control is the highest level of scientific understanding. Control is the demonstration that one event causes a specific change in another event. In Applied Behavior Analytic research, we seek to demonstrate control by showing that one event reliably causes changes in another event.

The study of behavior consists of direct observations of the relationships between environmental stimuli and the responses associated with them (Cooper et al., 2007). John Watson, the father of behaviorism, argued that the study of behavior should consist of direct observation of environmental stimuli and the responses associated with those stimuli. Later B.F. Skinner, who was influenced by Watson suggested that behaviors are both influenced by the events that occur prior to the behavior (i.e., antecedents) and those that occur immediately after the behavior (i.e., consequences; Cooper et al., 2007).

Behaviors that are influenced by the history of consequences are termed operant behaviors.

Following Skinner's work, Baer, Wolf, and Risley (1968) defined the critical features of ABA. Specifically, ABA was defined as the systematic application of behavioral principles to improve specific, socially important behaviors. The first dimension is applied, which means that the person receiving ABA therapy is receiving important, socially significant treatment and the behavior analyst can demonstrate the social importance of the intervention. The second dimension asserts that ABA research needs to be behavioral. This means that it focuses on observable behavior that can be seen and defined operationally. Analytic is the third dimension which states that behavior analysts must be able to determine if the intervention was responsible for the occurrence or non-occurrence of the target behavior. Technological is the fourth dimension, and this means that the experimenter has be able to describe, in detail, the techniques used for the intervention so that they are able to be replicated. Maintaining the relevance to basic behavior principles must be evident in all interventions and research; this is known as conceptually systematic which is the fifth dimension. The sixth dimension, effective, means that the interventions produce a large enough effect to be considered socially significant and important for the individual receiving the intervention. The last dimension is generality. Applied interventions should be designed and implemented with the intent for the interventions to operate in the natural environment after the formal intervention has ended (Baer et al., 1968).

Functional Communication Training

Functional communication training (FCT) is an intervention in which an appropriate communicative behavior is taught to replace challenging behaviors. For example, a child typically runs away from his parents when they turn off the lights at bedtime. They observe that he only runs away when the lights are turned off. If the lights are kept on or he is given a night light he stays in bed. They teach him to ask for the lights on or his night light instead of running out of the room. The communicative response is functionally equivalent to the challenging behavior meaning it produces the same reinforcer as the challenging behavior. In the example above the child is trying to escape the dark by running out of the room. His parents teach him a communicative response that allows him to escape the dark without engaging in the challenging behavior of running away so it is functionally equivalent. In FCT the communicative response is taught by prompting communication and providing function-based reinforcement contingent upon communication. In some instances, the child may need to be taught when they can ask for what they want. For example, if a child is asking for escape from a task or demand then procedures can be put in place to fade in those demands once communication has been taught. An example of this would be if a child was throwing tantrums to get out of doing their math homework, then the child could be taught to ask for help completing their work or to ask for a break. In either case, eventually the parents would probably like for the child to complete the work on their own. This is when the child should be taught when it is appropriate to ask for help or a break. The parents could start by telling the child that when they complete one problem then they can ask for help

or a break and then fade in more problems until the child is doing all the homework problems on their own.

There are a wide variety of topographies for communicative responses including vocalizations, signs, communication boards, word or picture cards, speech generating devices, or gestures (Brown, Wacker, Derby, Peck, Richman, Sasso, Knutson, & Harding, 2000; Shirley, Iwata, Kahng, Mazaleski, & Lerman, 1997). For example, if a child engages in aggressive behaviors such as biting to get a toy that he wants from a classmate, that child can be taught to ask for the toy that they want instead of biting. Asking for what they want gets the same result but is more socially appropriate. When implementing FCT, it is important to first identify the function of the target behavior in order to select an effective communicative response. The communicative response should be reinforced often at first and gradually prompts should be faded and reinforcement should be put on a variable schedule (Hanley, Iwata, & Thompson, 2001). In addition, FCT is more likely to be effective if paired with extinction or another behavior reduction procedure (Bird, Dores, Moniz, & Robinson,1989; Carr & Durand, 1985; Durand & Carr, 1992). According to the National Professional Development Center in autism spectrum disorder (2017), FCT meets the evidence-based practice criteria set by the National Professional Development Center in autism spectrum disorder with 12 single case design studies. FCT is an appropriate treatment for a variety of challenging behaviors that are maintained by access to social reinforcement (Tiger, Hanley, & Bruzek, 2008). The practice has been shown to be effective with learners in preschool to high school. Studies who met evidence-based practice criteria have demonstrated how FCT can be used effectively to address social skills, challenging behavior, communication, play, adaptive,

and school-readiness outcomes (Brown et al., 2000; Buckley & Newchok, 2005; Casey & Merical, 2006; Falcomata, Roane, Feeney, & Stephenson, 2010).

Generalization

Generalization is defined as behavior change that has not been directly taught. Generalization can take three primary forms: response maintenance, stimulus or setting generalization, and response generalization (Stokes & Baer, 1977). Response maintenance is the extent to which a learner continues to engage in the target behavior after the intervention responsible for the behavior change has been terminated. Stimulus or setting generalization is the degree to which a learner emits the target behavior in a setting or stimulus situation that is different from the instructional setting. A generalization setting is any situation in which the learner should engage in the target behavior, but the situation differs in a meaningful way from the instructional setting. The final form, response generalization, is the extent to which a learner emits untrained responses that are functionally equivalent to the trained target behavior. For example, a child may be taught to greet others by saying "hello" and then may start also saying "hi" to greet other people, without additional training.

A behavior change will only impact the learner's life if it occurs over time, is emitted in appropriate non-training situations, and each instance of the behavior varies appropriately (Stokes & Baer, 1977). Therefore, it is important to include generalization strategies in behavior analytic interventions in order to promote appropriate generalization (Baer et al., 1968; Stokes & Baer, 1977). Specifically, there is a need for

further investigation of effective generalization strategies that can be used with evidence-based practices, such as FCT.

Stimulus Control

Stimulus control is defined as a situation in which a behavior is altered by the presence or absence of an antecedent stimulus (i.e., specific cues or objects within the environment prior to the behavior of interest). In a stimulus control procedure there are two distinct stimuli involved including discriminative stimuli (i.e., S^D) and S^Δ. A discriminative stimulus (i.e., S^D) is a cue or object in the presence of which certain responses have been reinforced, and in the absence of which other responses have occurred and not been reinforced. A S^Δ is a cue or object in the presence of which the behavior is not reinforced. Stimulus control procedures can be implemented within a variety of interventions including FCT (Durand, 1999; Falcomata et al., 2013; fisher et al., 2013; Shamlian et al., 2016).

Research Questions

The purpose of this study is to evaluate the effect of discrimination training and fading from contrived to naturally occurring stimuli on generalization to novel naturally occurring stimuli. The specific research questions include: (a) Does a stimulus fading procedure and discrimination training result in discriminated responding with naturally occurring stimuli? (b) Does a stimulus fading procedure and discrimination training result in generalization to novel naturally occurring stimuli?

CHAPTER TWO

Review of the Literature

This review will synthesize the current literature on generalization of appropriate behaviors taught during FCT in order to identify research-based methods to promote generalization and identify directions for future research.

Search Procedures

A systematic electronic database search was conducted using Academic Search Complete, Education Research Complete, PsycARTICLES, Psychology and Behavioral Sciences Collection, PsycINFO, and ERIC. The terms *functional communication training, functional communication response, FCT,* and *functional equivalence training* were paired with *generaliz** to create four search term pairs. The database search yielded 128 articles after duplicates were removed. The titles and abstracts of the resulting 128 articles were examined to establish whether or not they met the inclusion criteria for the review. During the title and abstract screening, 110 articles were excluded and a total of 18 articles were kept for full text screening. Zero articles were excluded during the full text screening. Since the *Journal of Applied Behavior Analysis (JABA)* published the majority of the 18 included articles, a journal hand search was completed in *JABA* to identify additional articles that might meet the inclusion criteria. The hand search involved reading through the titles and abstracts of all articles in the issues from 2012 to present and then reading the full text to see if the article met the inclusion criteria. One additional article was identified during the hand search. Finally, an ancestry search was

conducted on all articles that met inclusion criteria. During the ancestral search, the articles cited in the reference lists of the included articles were reviewed based on the inclusion criteria described above. Four articles were identified via the ancestral search, for a total of 22 articles.

Inclusion and Exclusion Criteria

In order to be included in this review, studies were required to adhere to the following three criteria: (a) data were collected on challenging behavior during the study, (b) the study evaluated the efficacy of FCT as an intervention for challenging behavior, and (c) the study included an examination of generalization across contexts, stimuli, people, or over time for one or more participants. FCT was defined as teaching an appropriate communicative behavior to replace challenging behaviors, based on the function of the challenging behavior. Generalization was defined as data collection during sessions with an implementer, context or stimuli that was different from the initial implementer, context, or stimuli.

Data Extraction

Data were collected based on the following categories (a) participants characteristics, (b) functional behavior assessment (FBA) characteristics, (c) FCT characteristics, and (d) generalization characteristics. Participants characteristics included (a) the number of participants in each study, (b) participant gender, (c) participant age, (d) diagnosis, (e) topography of challenging behaviors. The FBA characteristics included (a) whether or not an FBA was conducted, (b) type of FBA conducted, and (c) results of

the FBA (i.e., function of challenging behavior identified). The FBA components were recorded as one of three categories: indirect (e.g., interview), direct observation (e.g., collecting ABC data during observations), and functional analysis. The methodological characteristics included (a) whether FCT was compared to another intervention, (b) type of communicative response taught, (c) treatment setting, and (d) treatment implementer. Generalization characteristics included (a) type of generalization measured, (b) the type of stimulus for stimulus generalization, (c) how generalization was promoted based on Stokes and Baer (1997), and (d) generalization procedures used. The types of generalization stimuli were categorized as implementer, setting (where it took place), instructional task, and stimulus cues. The procedures used during generalization sessions were recorded as reinforcement for appropriate behavior, prompting for appropriate behavior, extinction for challenging behavior, and/or reinforcement for challenging behavior.

The generalization strategies were recorded based on the Stokes and Baer (1977) framework and included (a) "sequential modification", (b) "introduce to natural maintaining contingencies", (c) "train sufficient exemplars", (d) "train loosely", (e) "use indiscriminable contingencies", (f) "program common stimuli", (g) "mediate generalization", (h) "train to generalize", and (i) "train and hope". "Sequential modification" was defined as generalization was assessed, and if it was absent or deficient, strategies were initiated to accomplish the desired generalization. "Natural maintaining contingencies" were defined as teaching a communicative behavior that typically results in the function-based reinforcement in the natural environment. "Train sufficient exemplars" was defined as teaching multiple exemplars of the antecedent

conditions or communicative behavior during FCT. “Train loosely” was defined as allowing for minimal control by teaching with different stimuli presented and/or reinforcing variation of the communicative topography. “Using indiscriminable contingencies” was defined as making the context in which the intervention is in place unclear to the participant (e.g., using intermittent reinforcement schedule). “Programming common stimuli” was defined as stimuli occurring in both the training and generalization settings, or incorporating naturally occurring physical stimuli that are frequently in the natural environment. “Mediate generalization” was defined as establishing a response as part of the new learning that is likely to be utilized in other natural contexts. “Train to generalize” was defined as providing the reinforcement contingency in the generalization context. “Train and hope” was defined as generalization was probed and documented but no other action was taken to promote generalization. This strategy was selected if no other strategies were used.

Table 1

Child Participants, Diagnosis, Setting, Implementer, Topography of Challenging Behavior

Citation	Child Participants	Diagnosis	Setting	Implementer	Topography of Challenging Behavior
Berg et al. (2007)	Three 4-year-old males, one 5-year-old male	Developmental delay, speech disorder, language disorder, and PDD-NOS	Home	Parent	Aggression, property destruction, noncompliance
Carr & Kemp (1989)	One 3-year-old female, one 3-year-old male, two 5-year-old males	Autism	School	Teacher	Aggression, SIB, motor stereotypy
Davis et al. (2012)	One 8-year-old female, one 12-year-old male, one 17-year-old male, one 18-year-old male	Intellectual disability, autism, SEBD, cerebral palsy, and feeding disorder	School	Teacher	Aggression, property destruction, throwing, SIB, elopement, motor stereotypy, Screaming, noncompliance
Derby et al. (1997)	Two 2-year-old males, one 3-year-old male, one 3-year-old female	Developmental delay, visual impairment, intellectual disability, cerebral palsy epilepsy, and severe language delay	Home	Parent	Throwing, SIB, tantrum, noncompliance
Drasgow & Halle (1996)	One 4-year-old female	Inconclusive (autism or rhetts)	School	Therapist	Tantrum, elopement, screaming
Durand (1999)	One 3-year-old male, one 5-year-old male, one 9-year-old male, one 11-year-old male, one 15-year-old female	Intellectual disability, cerebral palsy, and autism	School and Community	Teacher	Aggression, throwing, SIB, tantrum, and screaming

(continued)

Table 1

Child Participants, Diagnosis, Setting, Implementer, Topography of Challenging Behavior

Citation	Child Participants	Diagnosis	Setting	Implementer	Topography of Challenging Behavior
Durand & Carr (1991)	One 9-year-old male, two 12-year-old males	Autism, intellectual disability, pervasive developmental disorder	School	Experimenter	Aggression, SIB, tantrum, and falling to the floor and laughing
Durand & Carr (1992)	Three 3-year-old males, four 4-year-old males, two 4-year-old females, three 5-year-old males	Autism, intellectual disability, attention deficit/hyperactivity disorder	School	Undergraduate psychology students	Aggression, property destruction, tantrum, and noncompliance
Falcomata et al. (2013)	One 2-year-old male, one 3-year-old male, one 4-year-old male	Autism and developmental delay	Home and Clinic/Hospital	Parent and Experimenter	Aggression, SIB, and tantrum
Fisher et al. (2015)	One 5-year-old male, one 6-year-old male, one 10-year-old male	Stereotypic movement disorder, PDD-NOS, and ODD	Clinic	Therapist	Aggression, property destruction, SIB, tantrum, elopement, and motor stereotypy
Franco et al. (2009)	One 7-year-old male	Autism	School	Experimenter	Noncompliance and vocal stereotypy
Horner & And (1990)	One 14-year-old male	Intellectual disability	School	Experimenter	Aggression, property destruction, elopement, and screaming
Mancil et al. (2009)	Two 4-year-old males, one 7-year-old male	Autism	Home and school	Parent	Aggression, SIB, and tantrum
Mancil et al. (2016)	One 4-year-old female, two 5-year-old males	Autism	School	Teacher and peers	Aberrant behavior (not specified)
Matson et al. (2008)	One 11-year-old female	Autism and Attention deficit hyperactivity disorder	Clinic and home	Therapist and parent	Aggression, SIB, and screaming

(continued)

Table 1

Child Participants, Diagnosis, Setting, Implementer, Topography of Challenging Behavior

Citation	Child Participants	Diagnosis	Setting	Implementer	Topography of Challenging Behavior
Moes & Frea (2002)	Two 3-year-old males, one 3-year-old female	Autism	Home	Parent and siblings	Aggression, tantrum, elopement, motor stereotypy, vocal stereotypy, and screaming
O'Neill et al. (2001)	One 6-year-ol male, one 15-year-old male				
Rispoli et al. (2014)	Two 3-year-old males, one 4-year-old male	Autism and PDD-NOS	Clinic and home	Therapist or parent	Aggression, throwing, SIB, screaming, and pushing implementer's hand away
Schindler & Horner (2005)	One 4-year-old male, one 4-year-old female, one 5-year old-male	Autism and Charge Syndrome	School and home	Teacher and Parent	Aggression, throwing, tantrum, noncompliance, screaming
Shamlian et al. (2016)	Two 5-year-old, one male 10-year-old	Autism and Cerebral Palsy	Unknown	Therapist	Aggression, throwing, SIB, screaming, grabbing, pulling on therapist
Wacker & And (1990)	One 7-year-old male, one 9-year-old-male, one 30-year-old female	Intellectual disability, autism, seizure disorder, and Phenylketonuria	Hospital	Therapist	Aggression, property destruction, SIB, tantrum, noncompliance, and motor stereotypy
Wacker et al. (2005)	One 1-year-old male, one 2-year-old male, two 2-year-old females, one 3-year-old male, one 3-year-old-female, four 4-year-old males, two 5-year-old males, one 5-year-old female, five 6-year-old males	Developmental delay, cerebral palsy, seizure disorder, PDD, atypical development, behavior disorder, autism, ADHD, Soto syndrome, speech and language disability, Rett syndrome, expressive communication disorder, Lesch-Nyhan Syndrome, Bronchial pulmonary dysplasia, Asthma, Microcephaly Vision, hearing impairment, and articulation disorder	Clinic, school, home, and community setting	Parent, teacher, and therapist	Aggression, property destruction, and SIB

Table 2

Generalization Measured, Type of Stimulus, Generalization Strategy, and Procedures

Citation	Generalization Measured	Generalization Strategies	Procedures
Berg et al. (2007)	People and setting	Natural contingencies, sufficient exemplars, and mediate generalization	Reinforcement and prompting for appropriate behavior
Carr & Kemp (1989)	People and setting	Sequential modification, natural contingencies, sufficient exemplars, indiscriminable contingencies, and mediate generalization	Reinforcement and prompting for appropriate behavior
Davis et al. (2012)	People and setting	Natural contingencies, program common stimuli, and mediate generalization	Reinforcement and prompting for appropriate behavior
Derby et al. (1997)	Time	Train and hope and mediate generalization	Reinforcement for appropriate behavior
Drasgow & Halle (1996)	People, setting, SD, and time	Sufficient exemplars and mediate generalization	Reinforcement for appropriate behavior
Durand (1999)	People and setting	Natural contingencies, program common stimuli, and mediate generalization	Reinforcement for appropriate behavior, prompting for appropriate behavior, and extinction for challenging behavior
Durand & Carr (1991)	People, setting, and time	Sequential modification, natural contingencies, and mediate generalization	Unknown
Durand & Carr (1992)	People	Train and hope	Unknown
Falcomata et al. (2013)	Setting	Program common stimuli and mediate generalization	Unknown

(continued)

Table 2

Generalization Measured, Type of Stimulus, Generalization Strategy, and Procedures

Citation	Generalization Measured	Generalization Strategies	Procedures
Fisher et al. (2015)	People and setting	Sufficient exemplars, program common stimuli, and mediate generalization	Unknown
Franco et al. (2009)	Setting	Natural contingencies, program common stimuli, and mediate generalization	Reinforcement for appropriate behavior
Horner & And (1990)	Unknown	Natural contingencies, program common stimuli, and mediate generalization	Unknown
Mancil et al. (2009)	Setting	Program common stimuli and mediate generalization	Reinforcement for appropriate behavior and extinction for challenging behavior
Mancil et al. (2016)	People and setting	Train and hope	Unknown
Matson et al. (2008)	People and setting	Natural contingencies, sufficient exemplars, and mediate generalization	Reinforcement for appropriate behavior, prompting for appropriate behavior, and extinction for challenging behavior
Moes & Frea (2002)	Unknown	Train and hope	Unknown
O'Neill et al. (2001)	SD	Mediate generalization	Reinforcement for appropriate behavior, prompting for appropriate behavior, and extinction for challenging behavior
Rispoli et al. (2014)	Time	Train and hope and mediate generalization	Reinforcement for appropriate behavior
Schindler & Horner (2005)	People and setting	Sequential modification, natural contingencies, and mediate generalization	Reinforcement for appropriate behavior

(continued)

Table 2

Generalization Measured, Type of Stimulus, Generalization Strategy, and Procedures

Citation	Generalization Measured	Generalization Strategies	Procedures
Shamlian et al. (2016)	SD	Natural contingencies, program common stimuli, and mediate generalization	Reinforcement for appropriate behavior
Wacker & And (1990)	People	Train and hope and mediate generalization	Reinforcement and prompting for appropriate behavior
Wacker et al. (2005)	People and setting	Natural contingencies, sufficient exemplars, train loosely, and mediate generalization	Unknown

Results

Twenty-two studies were included in this review. Table 1 summarizes the 22 studies that were analyzed in this review.

Participants Characteristics

Age, gender, and diagnosis. A total of 94 participants were included in the 22 identified studies, with 76 males (81%), 18 females (19%). Participants' ages ranged from 2 to 30 years old. Nine participants were between zero and two years old, 56 were between three and five years old, 23 were between six and twelve years old, five were between 13 and 18 years old, and one was more than 22 years old. Twenty-four participants were diagnosed with autism spectrum disorder, 11 were diagnosed with an intellectual disability, four were diagnosed with a developmental delay, four were diagnosed with developmental language disorder, three were diagnosed with pervasive developmental disorder-not otherwise specified (PDD-NOS), and two had an attention deficit hyperactivity disorder (ADHD) diagnosis. An additional 21 participants had multiple diagnoses. Seven of those participants had a primary diagnosis of an intellectual disability, six had a primary diagnosis (i.e. first diagnosis listed) of autism spectrum disorder, four had a primary diagnosis of a developmental delay, two had a primary diagnosis of Cerebral Palsy, one had a primary diagnosis of ADHD, and one had a primary diagnosis of stereotypic movement disorder. For 25 of the participants, the diagnoses were listed as multiple disabilities or developmental delay, but the specific diagnoses were not reported for these participants.

Topography of challenging behavior. The majority of participants engaged in aggression (52%, *n* = 49), In addition, 34 engaged in property destruction (36%), 34 engaged in self-injurious behavior (36%), 30 engaged in tantrums (30%), eight engaged in elopement (9%), 16 engaged in non-compliance or off task behavior (17%), 15 engaged in shouting or screaming (16%), 9 engaged in throwing (10%), eight engaged in motor stereotypy (9%), two engaged in vocal stereotypy (2%), and one engaged in grabbing items (1%). For three of the participants, the topography of challenging behavior topography was not specified. Aggression was defined as exhibiting one of the following (or similar) behaviors that have the potential to cause harm to another person. Examples of aggression include kicking, biting, hitting, scratching, and pinching. Property destruction was defined as throwing, breaking, or knocking over furniture or objects in the environment. Self-injurious behavior (SIB) was defined as the occurrence of a behavior that resulted in harm to one's own body. Some examples of self-injurious behavior include head banging, head-hitting, and hand-biting. Stereotypy was defined as a repetitive behavior of any kind.

Study Characteristics

Treatment setting. Thirteen studies were conducted in schools (59%), nine were conducted in the participants' homes (41%), five were conducted in a clinic (23%), two were conducted in hospitals (9%), and two were conducted in community settings (9%). The setting for one study was not reported (4%). Seven of the previously described studies included more than one setting.

Treatment implementer. A parent implemented the intervention in nine studies (41%), a clinical therapist implemented the intervention in seven studies (32%), a classroom teacher implemented the intervention in six studies (27%), and an experimenter implemented the intervention in four studies (18%). Undergraduate psychology students implemented the intervention in one study, siblings implemented the intervention in one study, and classroom peers implemented the intervention in another. For one study the implementer was not reported. Of the studies listed, seven used multiple implementers.

Functional behavior assessment. All of the studies conducted a functional behavior assessment (FBA; 100%, $n = 22$). Of those studies, 20 conducted a functional analysis (91%), eight conducted indirect assessments (36%), and six conducted direct observations (27%). Eight of the 22 studies used included more than one FBA component.

Functions of behavior. Eighteen participants engaged in challenging behavior maintained by access to tangible items (e.g., access to a preferred toy; 19%), 16 participants engaged in challenging behavior maintained by escape from demands (17%), 15 participants engaged in challenging behavior maintained by access to attention (16%), one participant engaged in challenging behavior maintained by automatic reinforcement (1%), and one participant engaged in challenging behavior to access a ritual (1%). The FBA for 26 participants indicated the children engaged in multiply maintained

challenging behavior (see Table 1; 28%). The FBA results were not conclusive for 13 participants (14%).

Other interventions used in the experiment. Twenty studies did not compare FCT to any other interventions (91%). Two studies compared FCT to different interventions (9%). One study did not compare treatments but implemented several treatments at once, in addition to FCT.

Communicative response. The topography of communication was a vocal communicative response for the majority of the participants (32%, $n = 30$). The topography of communication was sign language for 11 participants (12%), electronic assistive technology for 11 participants (12%), gestural responses for 11 participants (12%), and a picture exchange for 10 participants (11%). The topography of communication for picture exchange was handing either a picture or word card to the implementer. For one study the type of response taught was not specified. Multiple responses were taught to 13 participants in the included studies.

Generalization. A majority of the studies measured stimulus generalization (91%, $n = 20$). For two studies, the type of generalization measured was not specified. Of the studies that assessed stimulus generalization, 14 measured generalization across settings (64%), 13 measured generalization across people (59%), and four measured generalization with different discriminative stimuli (18%). Eleven studies assessed multiple types of stimulus generalization.

Procedures during generalization sessions. In the majority of studies, function-based reinforcement was provided for appropriate behavior during generalization sessions (64%, *n* = 14). Prompting for appropriate behaviors was provided in seven studies (32%) and extinction for the challenging behavior was included in five studies (23%). For nine of the included studies the procedures were not clearly described. No studies included reinforcement for challenging behaviors during generalization.

Generalization strategies. The majority of studies used the "mediate generalization" strategy (86%, *n* = 19). This is likely because a common recommendation when choosing the communicative response is to choose a response that is likely to be reinforced outside of the treatment setting (Tiger, Hanley, & Bruzek, 2008). "Train to generalize" was used as a generalization strategy in 15 studies (68%), "introducing natural maintaining contingencies" in ten studies (45%), "training sufficient exemplars" in seven studies (32%), "programming common stimuli" in four studies (18%), "train and hope" in six studies (27%), "sequential modification" in three studies (14%), "training loosely" in one study (5%), and "indiscriminable contingencies" in one study (5%). Eighteen of the included 22 studies implemented two or more of the generalization strategies (Stokes & Baer, 1977).

Discussion

Overall, 22 studies that evaluated the efficacy of FCT assessed generalization. FCT was primarily used to reduce challenging behavior such as aggression, property destruction, self-injury, and tantrums. Of the 22 included studies, 22 studies (100%)

included a functional behavior assessment. Within those studies, 60 participants (64%) had challenging behavior which was maintained by positive reinforcement.

Although specific attributes of the FCT interventions varied across each study, a common theme in the literature appeared. FCT interventions tend to include the strategy of naturally "mediating generalization" because the communicative response is typically associated with the function-based reinforcement in the natural environment (Tiger, Hanley, & Bruzek, 2008; Stokes & Baer, 1977).

It was found that 93% of participants within the 22 studies were between the ages of three and 12. This indicates a need for further research because there are currently no studies that included participants between the ages of 19 to 22. In addition, 100% (n =22) of the studies in this review included children or adolescents with developmental disabilities as participants. No studies included typically developing children.

Limitations of the Literature Review

This review of the literature was completed with some limitations that should be noted. The lack of detail in the description of the generalization phase for the 22 studies found may have affected the results. In addition, the generalization strategies used often were not stated in the literature and were inferred by the reader based on the description of the procedures. Finally, a second rater did not replicate the search or descriptive coding and therefore inter-rater agreement data were not obtained for this literature review which decreases the reliability of the review.

Directions for Future Research

For future research it may be beneficial to study the differences in promoting response verses stimulus generalization. Few studies incorporated the strategies of training loosely or "using indiscriminnable contingencies" and there is need for additional research in this area (Stokes & Baer, 1977). Four studies used stimulus control procedures (18%). One study by Shamlian et al. (2016) compared the effects of contrived and naturally occurring S^Ds directly during acquisition and generalization of communication responses when they introduced the multiple schedules in novel settings in which the naturally occurring stimuli were either easy or difficult to discriminate. This resulted in the conclusion that contrived stimuli showed greater generalization of the communication response taught than naturally occurring stimuli. However, none of the previous studies have evaluated the effect of discrimination training and fading from contrived to naturally occurring stimuli on generalization to novel naturally occurring stimuli. Although Shamlian et al. (2016) incorporated both contrived and naturally occurring stimuli they did not incorporate a fading procedure prior to assessing generalization to novel settings and did not incorporate the naturally occurring and contrived stimuli simultaneously which should be included in future research.

Conclusions and Implications for Practice

Overall, "mediate generalization" was the most widely used strategy among the studies in this review with 19 studies utilizing this strategy (Stokes & Baer, 1977). Therefore, it is important for practitioners to implement this strategy when working on generalization with their clients. Train to generalize was the second most used strategy,

with 15 studies. This is another good strategy for practitioners to use because it allows you to train and have greater control in the generalization phase. The majority of studies taught a vocal communicative response, but sign language and electronic assistive technology were also common communication topographies. This shows that the type of communicative response chosen should be selected individually based on the needs and skills of each individual child.

CHAPTER THREE

Methods

Participants

Inclusion Criteria. Participants were recruited for this study from a university-affiliated ABA clinic. Informed consent was obtained from a parent prior to beginning any study procedures for all participants.

Dwight (pseudonym) was a three-year-old Caucasian male, who had been diagnosed with autism. His targeted challenging behavior was aggression in the form of hitting and kicking.

Billy (pseudonym) was a four-year-old Hispanic male, diagnosed with autism. His targeted challenging behaviors were screaming and head hitting.

Setting

The research sessions took place at Baylor Center for Assessment Research and Education, which is a part of Baylor Center for Developmental Disabilities.

Implementers

The implementer for this study was a master's student in Educational Psychology with a specialization in Applied Behavior Analysis. The implementer was supervised by a BCBA or BCBA-D throughout the project.

Materials

Throughout the study, data collection materials, such as paper and pencil, were used. For the multiple stimulus without replacement preference assessment five items were used (e.g., ball popper, tractor, race car, playdoh). Items were selected based on parent input. During the functional analysis and intervention, toys and materials associated with academic demands were present (e.g., inset puzzles, blocks, tambourine, tracing worksheets). During the treatment evaluation, a communication card was present as well as highly and moderately preferred tangible items for each participant. During the discrimination training evaluation different antecedent cues (e.g., blue or yellow card), toys (e.g., ball popper, blocks, shape sorter), and household objects (e.g., broom, vacuum, book, notebook, binder, iPhone) were present.

Data Collection

Each session of the functional analysis and treatment evaluation was 5 min long.

Dependent Variables

Data were collected on the rate of challenging behavior and communication responses. Challenging behavior was defined individually for each participant and included behaviors that interfered with social or academic functioning. For Dwight aggression was defined as one or more of the following: foot making contact with an object or person using a swinging motion or hand making contact with another person in a way that is not socially acceptable (high five would not be an example of hitting). For Billy, SIB (head hitting) was defined as making contact to the head with an object or any part of the person's own body. Screaming was defined as an "ahhh" sound above

conversational level. Percent accuracy for communication responses was calculated by recording the accurate card exchanges in the S^D phase (see discrimination training evaluation below) and dividing it by the total number of card exchanges and multiplying that by 100. Communication was defined as the participant handing the picture/word card to the therapist or verbally asking for attention or a tangible item (e.g., "Let's play" card or "Ball Popper" card).

Interobserver Agreement (IOA)

In order to evaluate the reliability of each independent data collectors' measurement during observation, two independent observers collected data during a portion of the sessions. Interobserver agreement (IOA) was collected during at least 30% of the sessions across all phases. IOA was collected by a secondary data collector; the primary and secondary data collectors took data on the frequency of challenging behavior and communication responses, and accuracy of generalization. Total count IOA was taken as the smaller count divided by the larger count times 100. For Billy's functional analysis IOA was recorded for 30% of sessions with 100% agreement for all sessions. Secondary observers recorded IOA data for 30% of Billy's treatment evaluation sessions with an average agreement of 98% (range 92 to 100%). IOA for Billy's discrimination training was collected for 30% of sessions with 100% agreement. For Dwight's functional analysis IOA was recorded for 30% of sessions with 100% agreement for all sessions. In addition, IOA was recorded for 30% of Dwight's treatment evaluation with 100% agreement for all sessions. IOA was collected for 37% of Dwight's discrimination training sessions with 100% agreement.

Experimental Design

Prior to treatment a functional analysis was administered. The functional analysis consisted of a multi-element design with four conditions: attention, tangible, escape, and play. The conditions were randomized within every set of four sessions. The treatment evaluation consisted of a reversal design (e.g., ABAB or withdrawal design) which included the following phases: baseline, FCT, baseline, and FCT phase. Each phase consisted of at least five sessions.

Procedures

Functional analysis procedures. Prior to conducting the functional analysis, a caregiver interview called the Functional Analysis Screening Tool was given (Iwata, DeLeon, & Roscoe, 2013).

A functional analysis was conducted based on procedures described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994), with sessions that were 5 min in duration. Each functional analysis included an attention, escape, demand, and play (control) condition. Based on the results of a multiple stimulus without replacement preference assessment (DeLeon & Iwata, 1996), highly preferred items were included in the tangible condition and moderately preferred items were included in the attention and play conditions.

The play condition served as a control condition. The play condition consisted of having moderately preferred toys out for the participant to play with. The implementer

provided attention at least every 10 s, placed no demands, and ignored any inappropriate behavior including the target behavior.

The attention condition consisted of having moderately preferred toys out with which the participant could play. Next, the implementer told the participant he or she needed to play by themselves. If the participant engaged in the target challenging behavior, which was defined individually for each participant, the implementer provided the participant with socially appropriate attention for 20 s after the challenging behavior ended. If the participant engaged in any other non-target challenging behavior, then it was ignored (e.g., if the target behavior is kicking then crying, whining, and any other behavior would be ignored).

The escape condition consisted of a task demand. The implementer instructed the participant to complete the task at least every 5 s. The implementer used a least-to-most prompting hierarchy (verbal, verbal and model, verbal and physical) and praised the participant when he or she completed the task. If the participant engaged in the target challenging behavior, then the implementer removed the task for 20 s and withheld demands until 20 s after the challenging behavior ended. If the participant engaged in any other non-target challenging behavior, then it was ignored.

The tangible condition consisted of having moderately preferred toys accessible with which the participant could play. Prior to the start of the session, the implementer provided the participant with a highly preferred toy for 20 s. After 20 s elapsed, the implementer took the highly preferred toy from the participant and withheld access. If the participant engaged in the target behavior, then the implementer provided him with the

highly preferred toy until the behavior had ceased for 20 s. If the participant engaged in any other non-target challenging behavior, it was ignored.

Treatment evaluation baseline. Baseline consisted of the functional analysis condition with the highest rates of challenging behavior, depending on the function identified in the functional analysis.

Pre-FCT training. For pre-FCT training, moderately preferred play materials were present. For tangible pre-training one highly preferred item was also present. During the first 5 trials the implementer prompted the participant on a 0-s delay using a full physical prompt to engage in the communicative response. The implementer prompted for communication at the beginning of the session, and after the end of every reinforcement period. If the child engaged in target challenging behavior, the implementer waited for a 3 s break in challenging behavior then provided the highest level prompt for communication. Contingent upon prompted or unprompted communication, the implementer provided 20 seconds of access to the function-based reinforcement. After the first 5 trials and 2 consecutive trials without challenging behavior, the implementer prompted the participant on a 5-s delay. If the child engaged in a non-target challenging behavior, the implementer ignored the behavior. The teaching trials were complete after the child engaged in independent communication for two consecutive trials and did not engage in the target challenging behavior during those trials.

FCT. The FCT treatment was based on the results of the functional analysis. Either attention or tangible FCT was implemented based on the functional analysis condition with the most challenging behavior.

For the attention FCT, moderately preferred play materials were present. The implementer indicated that the child needed to play by himself. If the child engaged in the target challenging behavior, the implementer ignored the behavior. Contingent upon unprompted communication, the implementer provided 20 s of attention. If the child engaged in a non-target challenging behavior, the implementer ignored the behavior.

For the tangible FCT, moderately preferred play materials were present. The implementer provided access to the highly preferred item for 20 s, then withheld access. Contingent upon unprompted communication, the implementer provided 20 s of access to the tangible item. If the child engaged in the target challenging behavior, the implementer ignored the behavior.

The communicative response taught was handing a laminated card to the implementer. If the participant handed the card to the therapist or verbally asked for attention or a tangible item, it was counted as a communication response. For one participant the communicative response was to hand a card to the implementer that said, "Play with me," on it. For the other participant the communicative response was to hand a card to the implementer that said, "Ball popper," on it.

Discrimination training evaluation. The discrimination training evaluation included three stimulus conditions: contrived stimuli, naturally occurring training stimuli, and naturally occurring generalization stimuli. The contrived stimuli consisted of one

contrived S^D and one contrived S^Δ . The contrived stimuli were different colored cards (see Table 3). The colored cards were counterbalanced across participants. The naturally occurring training stimuli consisted of three naturally occurring S^Ds and three natural S^Δs (see Table 4). The natural generalization stimuli consisted of three natural S^Ds and three natural S^Δs that differed from the training stimuli (see Table 5). Each session was 6 min in length, with 3 min of the S^D component and 3 min of the S^Δ component (with the exception of the initial teaching sessions), randomized in 1 min blocks.

Table 3
Stimuli During Contrived Sessions

Participant Name	S^D	S^Δ
Billy	Blue card	Yellow card
Dwight	Yellow card	Blue Card

Table 4
Natural Stimuli During Natural Training Sessions

S^D	S^Δ
Sitting reading magazine	Vacuuming
Playing with blocks	Writing (in notebook)
Looking at phone app	Phone call (on cell phone)

Table 5
Natural Stimuli During Natural Generalization Sessions

S^D	S^Δ
Sitting reading a book	Sweeping the floor
Playing with ball popper/shape sorter	Writing (in binder)
Looking at iPad app	Phone call (on land line)

Pre-discrimination training. Sessions consisted of at least five sessions with the naturally occurring training stimuli. Each session was six minutes in length with and equal time between the S^D and the S^Δ. During each session, challenging behavior was ignored (i.e., extinction) and communication responses resulted in function-based reinforcement in the presence of both the S^D and the S^Δ.

Discrimination training. Each session was six min long. The first session of FCT discrimination training began with the entire session with the paired contrived and natural S^Ds combined. In the presence of the combined S^Ds, each communicative response resulted in 20 s of access to the reinforcer. The implementer then introduced the paired contrived and naturally occurring S^Δs. In the presence of this stimulus, the communicative response resulted in extinction for every instance. When the S^Δ was introduced, sessions began by having five min with S^Ds and 1 minute with the S^Δs. The length of time with the S^Δs present increased by 1 minute every session with an 80% or more reduction in challenging behavior per minute until the session consisted of 3 min extinction (50% of the session) with the S^Δs and 3 min with the S^Ds with every instance of communication being reinforced (50% of the session). During training sessions, response restriction was in place during the S^Δ component. This meant that during the S^Δ component the communication card was removed. Training continued for a minimum of five sessions or until the participant met mastery criteria.

During subsequent sessions, the implementer faded out the contrived stimuli by making the card smaller and fading the color. The blue and yellow cards began as 4 by 6 inch laminated cards. When the child reached mastery criteria for communication, the

cards were reduced in size and transparency by 50%. Mastery criteria for communication consisted of 80% of functional communication responses occurring during the S^D component for two consecutive sessions. Once the child reached mastery with the smaller card with the faded color then the card was reduced in size and transparency to 25% of the original. When the child reached mastery with the smaller card, the card was removed completely. Sessions were terminated when the child met the mastery criterion without the card present.

Generalization. During the generalization phase three untrained S^Ds and three untrained S^Δs were assessed. Procedures were the same as in discrimination training sessions except that no response restriction was in place at this time.

Treatment Fidelity

Treatment fidelity was conducted during at least 50% of the sessions by a second observer. The treatment fidelity sheet included a step-by-step checklist of intended treatment implementation. The second observer used the checklist to evaluate the experimenters' accuracy in implementing the procedures. The treatment fidelity was calculated by dividing the total number of steps implemented correctly by the total number of steps in the session and then multiplying that by 100. During Billy's functional analysis treatment fidelity was taken for 100% of sessions with 100% fidelity. Treatment fidelity was also taken for 100% of Billy's treatment evaluation sessions with 100% fidelity. For 50% of Billy's discrimination training sessions treatment fidelity was collected with 98% fidelity (range 91 to 100%). For Dwight, treatment fidelity was taken

for 100% of functional analysis sessions with 100% fidelity. Treatment fidelity was taken for 80% of Dwight's treatment evaluation sessions with 100% fidelity. Throughout Dwight's discrimination training sessions treatment fidelity was taken during 50% of sessions with 100% fidelity.

Visual Analysis Procedures

The data were visually analyzed through the interpretation of the level, trend, and variability of performance during baseline and intervention conditions of the graph, (Horner et al., 2005). The immediacy of effect was visually analyzed as well in addition to the consistency across similar phases.

CHAPTER FOUR

Results

Functional Analysis Results

Billy

For Billy, the functional analysis demonstrated that challenging behavior was reinforced by access to tangible items (see *Figure 1*). Billy engaged in more challenging behavior during the tangible condition with an average of 2.64 responses per minute (RPM) of challenging behavior (range 1.8 to 3.2) in comparison to the play (control) condition (M = 0 RPM). He also engaged in lower rates of challenging behavior during the attention (M = 0.32 RPM, range 0 to 1.6 RPM) and escape (M = 0.08 RPM, range 0 to 0.4 RPM) conditions.

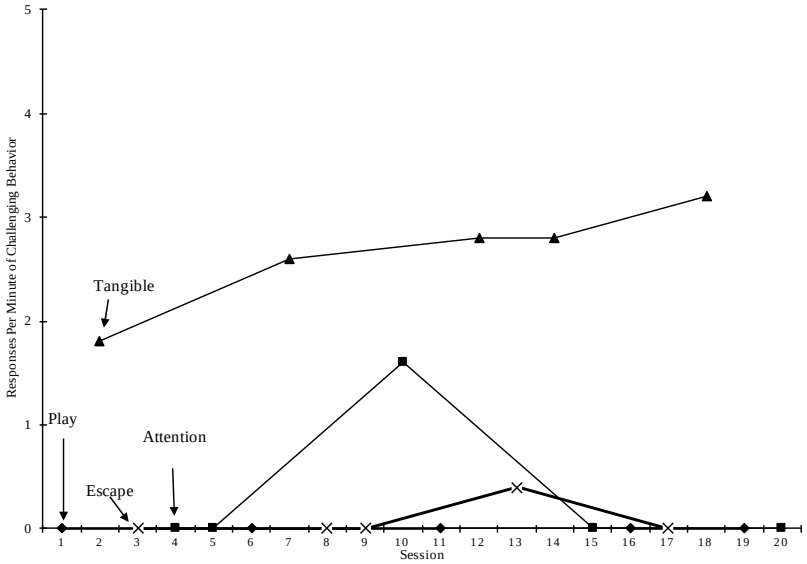

Figure 1. Billy's functional analysis results. Responses per minute of challenging behavior (SIB and screaming) across functional analysis conditions.

Dwight

Due to consistently low rates of challenging behavior, the functional analysis for Dwight was inconclusive. In addition, his functional analysis results indicated that he may no longer require a challenging behavior intervention. Based on the parent interview, the purpose of the intervention was to teach Dwight to request preferred activities and attention under the appropriate conditions (see *Figure 2*).

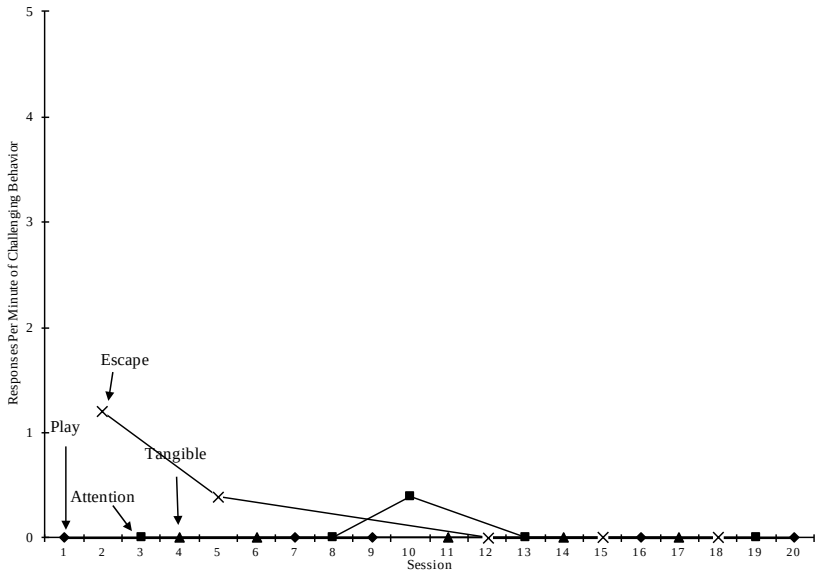

Figure 2. Dwight's functional analysis results.

Treatment Evaluation Results

Billy

During the initial baseline phase, the data were variable and the overall trend of challenging behavior was increasing with an average level of 2.36 RPM (range 1.6 to 2.8 RPM). There were overlapping data points between the initial baseline and intervention phase as well as in the second baseline and intervention phase. The average level during

the initial intervention phase for challenging behavior was 0.12 RPM (range 0 to 0.4 RPM). During the second baseline phase the data were stable with an average level of 2.64 RPM for challenging behavior (range 2.4 to 3 RPM). In the second intervention phase challenging behavior remained stable (see *Figure A.3*). The average level for challenging behavior was 0.12 RPM (range 0 to 0.2 RPM).

For communication during the initial baseline the level remained stable at 0 RPM across all sessions. Communication during the initial intervention phase remained consisted apart from one data point, and the overall trend remained stable with and average level of 1.48 RPM (range 0.4 to 1.8 RPM). During the second baseline phase communication had an average level of 0 which remained consistent across all sessions (see *Figure A.3*). The average level for communication was 2 RPM (range 1.6 to 2.2 RPM).

In summary, there were three demonstrations of effect and no non-demonstrations, resulting in strong evidence supporting a functional relation between the intervention and a decrease in challenging behavior for Billy (What Works Clearinghouse [WWC], 2017).

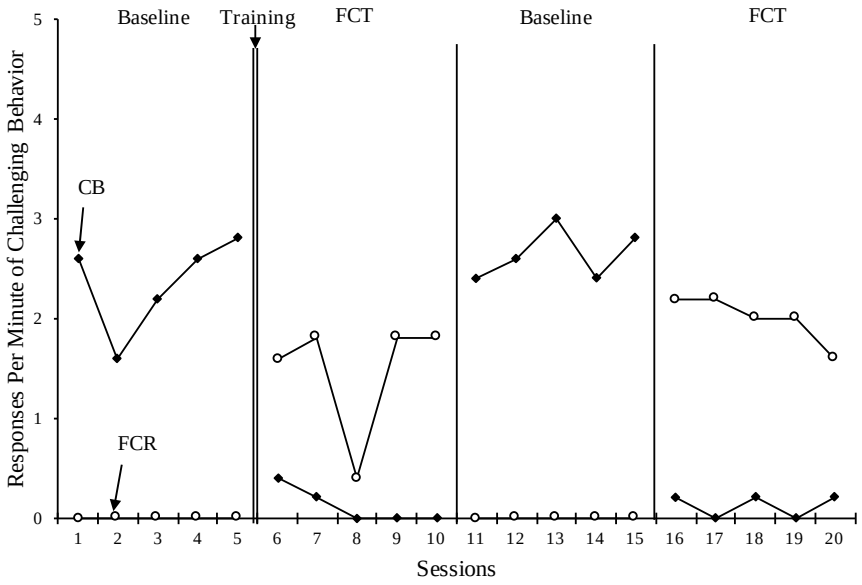

Figure 3. Billy's treatment evaluation results.

Dwight

Only one intervention phase was completed for Dwight since he exhibited almost no challenging behavior during the functional analysis (see *Figure 4*). During the intervention, Dwight's communication was slightly variable, with an average level of 1.53 RPM (range 1 to 2 RPM). Dwight did not engage in any challenging behavior during the intervention.

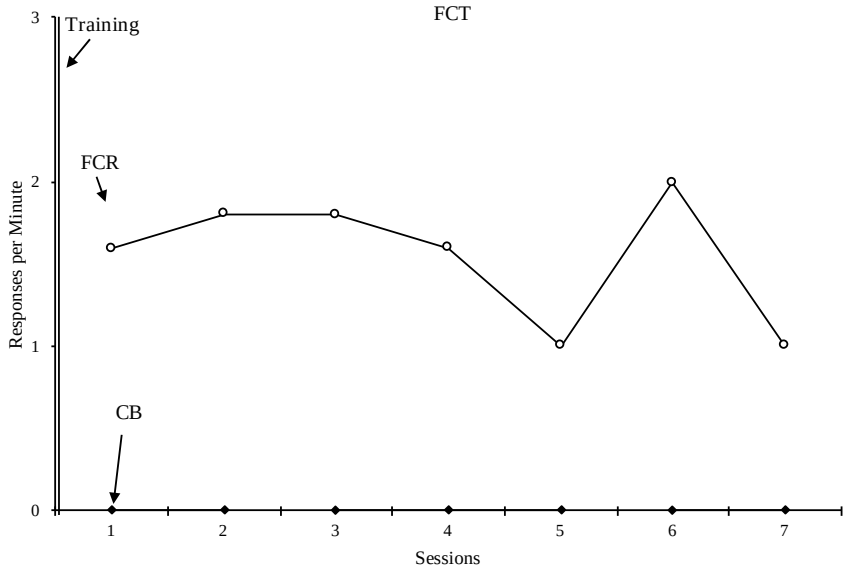

Figure 4. Dwight's treatment evaluation results.

Discrimination Training Results

Billy

During the pre-discrimination training phase, the data were variable for both percent accuracy of communication and responses per minute (see *Figure 5* and *Figure 6*). During pre-discrimination training, the average level of communication for the natural training S^D component was 0.81 RPM (range 0 to 1.67 RPM). The average level of communication for the natural training S^Δ component was 0.92 RPM (range 0.33 to 1.33). His average level of communication RPM for the generalization S^D component was 0.90 RPM (range 0 to 1.67 RPM). Billy's average level for communication RPM during the generalization S^Δ component was 0.62 RPM (range 0 to 1 RPM). Billy did not engage in any challenging behavior during the pre-discrimination training phase.

For the discrimination training phase, the data were stable for percent accuracy and challenging behavior (see *Figure 5* and *Figure 6*). He did not engage in any

challenging behavior during this phase. In addition, Billy's percent accuracy for communication was 100% across all but one training session. Billy's average percent accuracy for communication during training was 98.9% (range 86 to 100%). His average communication was 1.38 RPM (range 0.8 to 2 RPM) through the training S^D component. Billy engaged in the communication response once during the training S^Δ component. He did not engage in any challenging behavior during the discrimination training phase.

In summary, discrimination training was associated with high percent accuracy for Billy (see *Figure 5* and *Figure 6*).

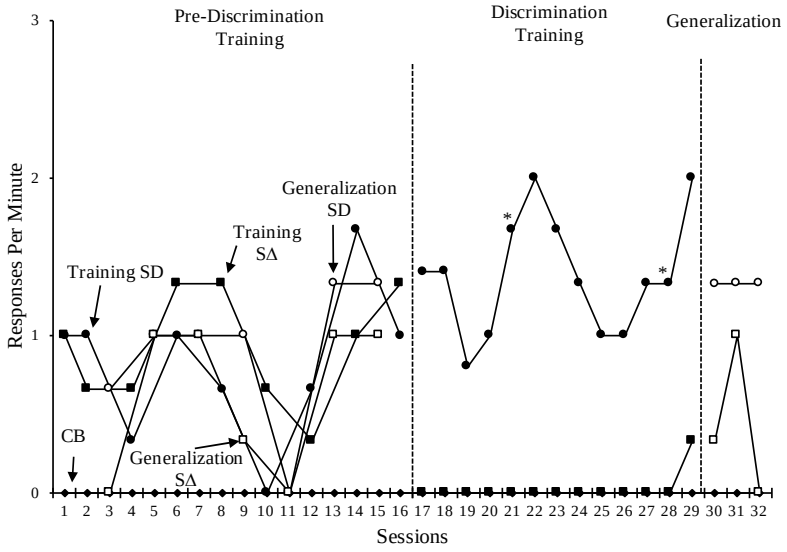

Figure 5. Billy's communication responses per minute (RPM) and challenging behavior (CB) during pre-discrimination training, discrimination training, and generalization. The first * indicates when the S^Δ component was completely faded into the session (50% for each component), and contrived stimuli fading began. The second * indicates when the contrived stimuli were completely faded from sessions.

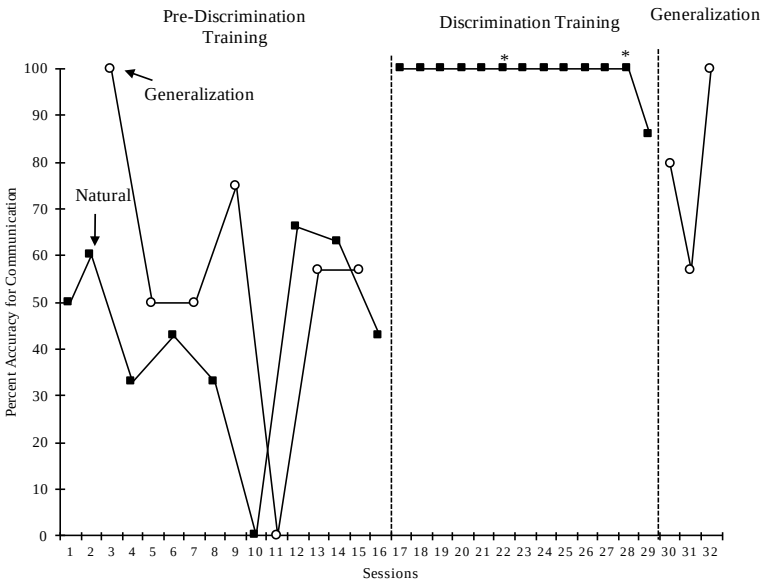

Figure 6. Billy's percent accuracy for communication during pre-discrimination training, discrimination training, and generalization. The first * indicates when the S^{Δ} component was completely faded into the session (50% for each component), and contrived stimuli fading began. The second * indicates when the contrived stimuli were completely faded from sessions.

Dwight

For Dwight, the communication data increased with a slight upward trend in both the S^{D} component and S^{Δ} component for generalization and natural training stimuli for the pre-discrimination training phase (see *Figure 7*). Dwight did not engage in any challenging behavior during the pre-discrimination training phase. During the natural training S^{D} component, the average level was 1.19 RPM (range 0.66 to 1.67 RPM). For the natural training S^{Δ} component, the average level was 0.86 RPM (range 0.33 to 1.33 RPM). Throughout the generalization S^{D} component, the average level was 1.33 RPM (range 1 to 1.67 RPM). For the generalization S^{Δ} component, the average level was 1.22 RPM (range 1 to 1.67 RPM). Dwight's percent accuracy of communication for the natural stimuli had an average level of 59.2% (range 50 to 66%). His average percent

accuracy of communication during the generalization stimuli component was 52.3% (range 44 to 63%; see *Figure 8*).

In discrimination training the average level for the RPM of communication was higher during the training S^D component than the average level during the training S^Δ component (see *Figure 7*) The average level for communication RPM during the training S^D component was 1.5 RPM (range 0.67 to 2 RPM). The average level during the training S^Δ component was 0.21 RPM (range 0.16 to 1 RPM). There was one instance of the target challenging behavior (aggression) during discrimination training. The average level of percent accuracy for communication during discrimination training was 91% (range 57 to 100%; see *Figure 8*).

In summary, discrimination training was associated with high percent accuracy (see *Figure 7* and *Figure 8*).

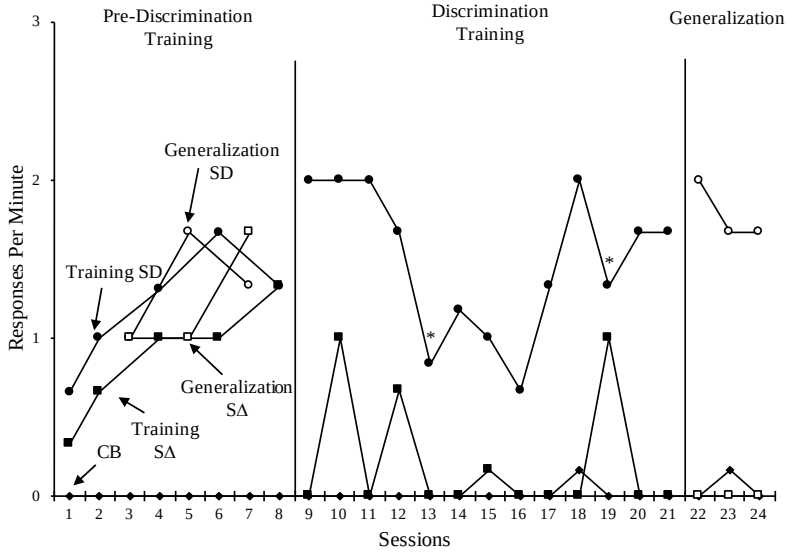

Figure 7. Dwight's RPM for communication and challenging behavior (CB) during discrimination training and generalization results. The first * indicates when the S^Δ component was completely faded into the session (50% for each component), and contrived stimuli fading began. The second * indicates when the contrived stimuli were completely faded from sessions.

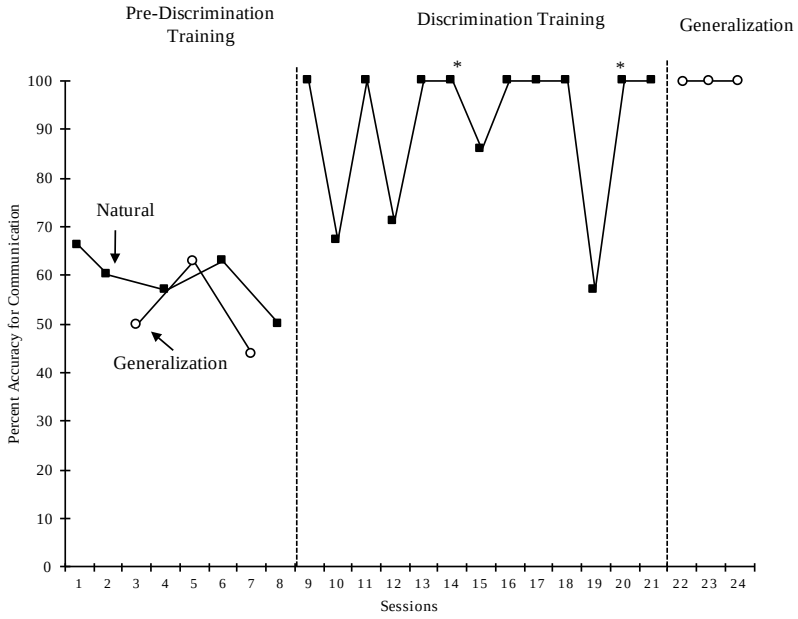

Figure 8. Dwight's percent accuracy for communication during training and generalization results. The first * indicates when the S^{Δ} component was completely faded into the session (50% for each component), and contrived stimuli fading began. The second * indicates when the contrived stimuli were completely faded from sessions.

Generalization Results

Billy

During the final generalization probes the average percent accuracy of communication was 79% (range 57 to 100%; see *Figure A.6*). In the generalization S^{D} component, the level for communication was 1.33 RPM across all sessions. For the generalization S^{Δ} component, the average communication was 0.44 RPM (range 0 to 1 RPM; see *Figure A.5*). No challenging behavior was observed during generalization.

Dwight

For the final generalization probes the percent accuracy of communication was 100% for all sessions. In the generalization S^D component, the average level of communication was 1.78 RPM (range 1.67 to 2 RPM). For the generalization S^Δ component, communication was stable at 0 RPM across all sessions (see *Figure A.7*). There was one instance of challenging behavior during the generalization probes.

CHAPTER FIVE

Discussion

For Billy, the treatment evaluation indicated teaching a functionally equivalent phrase was associated with a decrease in challenging behavior. This demonstrates that for Billy, a correct function was able to be identified and there was a relation between the functionally equivalent phrase and a reduction in challenging behavior. In addition, there were high rates of communication and low rates of challenging behavior for both participants. As well, a high percent accuracy for communication in the discrimination training phase was obtained for both participants was observed. Due to the use of response restriction for both participants it is unclear whether true independent discrimination was seen. However, this study indicates preliminary evidence that discrimination training results in an increase in accurate responding as compared to baseline, with both participants requesting the reinforcer more when reinforcement was available and less when it was not.

Limitations

The first limitation to address is the selection of the communication goal for one participant and lack of challenging behavior observed. One participant did not engage in challenging behavior during the functional analysis. For this reason, we targeted a communication phrase based on the parent interview instead. Also, there were only two participants in this study, and only one completed the full treatment evaluation.

Consequently, since there were fewer participants this intervention does not have a lot of generalizability. The another limitation was the use of response restriction for both participants during discrimination training. It was unclear from the results whether true independent discriminated responding was seen due to the use of response restriction. It is also possible that the card in the S^D component functioned as a stimulus indicating reinforcement was available. If this study were to be re-conducted it is suggested by the principle investigator that increasing the number of participants, removing the response restriction or fading response restriction, and changing the experimental design to a multiple baseline across participants design would increase the efficacy and experimental control of the study. It is also suggested that the discrimination training sessions be lengthened so that there are longer periods of time with the S^D and S^Δ components. One of the difficulties of this study was switching stimuli every minute.

Future Research

The current study can be expanded to include adapting procedures for escape maintained challenging behavior since no participants in this study exhibited challenging behavior maintained by escape from demands. In addition, future research should compare fading with contrived stimuli to implementing with only natural stimuli on the immediacy of effect and reduction of challenging behavior

Conclusions and Implications for Practice

This study contributes information that practitioners can use in the assessment and treatment of challenging behavior. Practitioners should continue to use FCT as an

intervention for reducing challenging behavior (Brown et al., 2000; Buckley & Newchok, 2005; Casey & Merical, 2006; Falcomata et al., 2010). In addition, this study included preliminary evidence for pairing contrived and natural stimuli to promote discriminated responding. Therefore, practitioners should consider explicitly teaching the conditions under which it is appropriate to ask for function-based reinforcement.

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