ABSTRACT

The Reduction of Self-Injurious Behavior in the Presence of Functional Communication Training and Preference of Communication Modality for Children with Autism Spectrum Disorders

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The use of functional communication training to reduce challenging behaviors such as self-injury has been demonstrated to be effective for children with Autism Spectrum Disorders (ASD) in a variety of settings. However, the preference of communication modality when offered a choice has been evaluated solely by Danov and colleagues (2010) to identify if some modes are broadly more preferred and therefore may be more effective in reducing challenging behavior. The current study will address children diagnosed with ASD that lack verbal communication skills and exhibit self-injury maintained by access to tangibles. Each a participant will be taught two modes of communication, a picture card and a speech-generating device, in alternating teaching trials. Following the mastery of manding with both modes, the child will be evaluated on preference of communication mode when both are presented for the same tangible reinforcer. The presence of self-injury will be recorded throughout each session.

The Reduction of Self-Injurious Behavior in the Presence of Functional Communication Training and Preference of Communication Modality for Children with Autism Spectrum Disorders

by

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CHAPTER ONE

Introduction

Challenging Behaviors in Developmental Disabilities

Autism

The DSM-V identifies an Autism Spectrum Disorder (ASD) as a disorder primarily consisting of communication deficits and lacking social cues. Autism is diagnosed by the following criteria: (a) deficits in social communication and interaction across several contexts, (b) repetitive and restrictive patterns of behavior,(c) presenting of symptoms during the early developmental stage, with barriers presenting as linguistics should be developing, and (d) clinically significant problems in social situations (DSM-V, 2013). For example, a child with autism may struggle with developing relationships or having a normal back-and-forth conversation. Additionally, more severe forms of the diagnosis will result in minimal use of language, rare initiation of interaction, and the inability to function independently (DSM-V, 2013).

Common behavioral patterns of ASD include but is not limited to: aggressive behavior, being dependent on routine, struggling with differing environments, and being unable to appropriately read social cues (DSM-V, 2013). Challenging behavior, most commonly characterized through aggression and self-injury, is especially common, with a prevalence rate of 53% for all diagnosed with ASD (Mazurek, Kanne, & Wodka, 2012). As explained by Dominick et al. (2007), aggression has been shown

to present itself significantly when cognition and language deficits are more severe, and self-injury specifically correlates with a lack of ability to use expressive language. If these children are unable to express their wants and needs with appropriate communication, frustration may be contributing to this correlation.

Self-Injury

Self-injury is any injury resulting from physical actions towards an individual's own body (Fee & Matson, 1992). Nearly half of all children with autism display some form of self- injury (Duerden et al., 2012). This prevalence rate may even reflect an underestimate, as there is concern that self-injury among young children is under diagnosed (Oliver & Richards, 2015).

Moreover, self-injury is correlated with intellectual deficits; individuals with more significant intellectual deficits are more likely to engage in self-injury (Dominick et al, 2007). Similarly, lack of social contact is correlated with increased self-injury (Oliver & Richards, 2015). This is particularly significant for individuals with significant developmental disabilities because they are often placed in environments with little social interaction (e.g., residential facilities, sheltered workshops, personal home) (Matson, 2009).

The topographies of self-injury among individuals with ASD found in the literature vary greatly, but include head hitting (Bird et al., 1989; Danov et al., 2010; Day et al., 1994; Harding et al., 2005; Kahng et al., 1997), biting self (Bird et al., 1989; Harding et al., 2005; Danov et al., 2010; Day et al., 1994; Harding et al., 2005; Wacker et al., 1990; Worsdell et al., 2000), hitting self (Bird et al., 1989; Danov et al., 2010; Day et al., 1994; Derby et al., 1998; Harding et al., 2005; Kahng et al.,

1997;Worsdell et al., 2000), scratching self (Casey & Merical, 2006; Danov et al., 2010), and eye gouging (Harding et al., 2005; Moore, 2010).

Similarly, the function of self-injury also varies. Various research has documented self-injurious behavior maintained by access to tangibles (Danov et al., 2010; Kurtz et al. 2003; Wacker et al., 1990; Worsdell et al., 2000), attention, (Derby et al., 1998; Kurtz et al., 2003; Worsdell et al., 2000) escape (Casey & Merical, 2006; Khang et al., 1997; Kurtz et al., 2003), and automatic reinforcement (Hall et al., 2014). Clearly, the form and function of self-injury varies across the ASD population.

Applied Behavior Analysis

Applied behavior analysis is the most widely recognized treatment for individuals with intellectual and developmental disabilities to yield promising results (Matson et al., 2012). Applied behavior analysis, was described in detail by Baer, Wolf, and Risley (1968). Baer and colleagues defined applied behavior analysis as an applied approach to changing socially problematic behaviors in a controlled setting and generalizing the improved alternatives to the environments in which they occur. Specifically, they describe seven dimensions of applied behavior analysis: applied, behavioral, analytic, technological, conceptually systematic, effective, and generalizable.

The term applied means that the field of applied behavior analysis targets behaviors and individuals that are important to our society, as opposed to selecting behaviors and organisms that are simply easy to change or treat. In regards to the term

behavior, applied behavior analysis emphasizes change in what a person does, versus changes in unobservable mental states.

Additionally, applied behavior analysis is not limited to treating a particular topography or topography class; applied behavior analysis can be utilized to treat any behavior. Analysis refers to the fact that applied behavior analysis must include an analysis of treatment effects. Taking an applied approach to behavior places value on the relevance of the behavior change for the individual and emphasizes the concise measurement of the events occurring within that environment, in a quantifiable manner. Additionally, an applied behavioral intervention must exercise control over contributing variables in order to manipulate the exact dimensions that contributed to the change in behavior. Referred to as one of the most effective forms of treatment for problem behavior, applied behavior analysis improves social and communicative behaviors and increasing learning skills (Rosenwasser & Axelrod, 2001).

The remaining four components of applied behavior analysis; that is, technological, conceptually systematic, effective, and generalizable, each play significant roles as well. In terms of technological, the behaviors addressed in applied behavior analysis must be clearly defined with all components properly incorporated, in order to allow for simple and precise replication of the procedures. Being conceptually systematic essentially equates to relevance; if applied behavior analysis techniques are going to be used, prompts need to be faded and behaviors need to be molded to model behavioral concepts long-term for the individual.

Additionally, effectiveness is important as it is the practical importance of an intervention. The need for behavior reduction needs to be evaluated then analyzed after

treatment to determine whether this component has ultimately taken place. The final dimension, generalizable, is crucial in applied behavior analysis. This recognizes whether behaviors and the techniques used to implement them will be relevant in different environments, across other behaviors, or throughout the passage of time, thus proving that the behavior did, in fact, change (Baer, Wolf, & Risley, 1968).

Applied behavior analysis evolved within a research environment with B.F. Skinner's *The Behavior of Organisms* in 1938. Skinner set out to determine the variables that influenced behavior change and the effect that these behaviors would have on society (Skinner, 1938).

Initially referring to Thorndike's Law of Effect, Skinner's publication introduced the primary types of behavior, and coined the term operant behavior to describe voluntary response to stimuli, as the behavior "operates upon the environment to generate consequences" (Skinner, 1938). Skinner explained that operant behaviors are influenced by the consequences that have followed those behaviors in the past, or their past effects. He was able to apply his principles of operant conditioning to pigeons and rats that would press levers at higher rates when reinforcement was systematically delivered after a set number of responses.

However, in order to effectively evaluate behavior, the other contributing variables had to initially be controlled and manipulated to isolate and identify the responsible factors. After identifying such functional relations between an environment and the responses it can provoke, Skinner applied it on a larger scale; one that could address more complex behavior in more varied environments (Skinner, 1938). Along with this research, he was the first individual published to suggest that

internal behaviors such as thoughts and emotions had the potential to be analyzed in the same manner as external behaviors, as individuals have needs and wants that could be satisfied by these external behaviors interacting with the environment to be reinforcing (Skinner, 1938). The application of applied behavior analysis to individuals with developmental disabilities such as autism evolved over the course of several years. When applied behavior analysis was applied to humans, it was necessary to analyze language from a behavior analytic perspective. Skinner coined the term *verbal behavior* and defined it as any behavior reinforced through the facilitation of another person (Skinner, 1948). Skinner emphasized the function of verbal behavior, rather than the form and analyzed verbal behavior no differently than any other behavior. Therefore, vocalizations could be deemed verbal behavior, but by the same definition, problem behavior could be communicative as well. Verbal behaviors were operant behaviors, meaning the probability of the occurrence of verbal behavior was influenced by past outcomes for similar behaviors, which was a meaningful approach to broaden the understanding the development of verbal behavior.

After Skinner's research acknowledged that a lack of vocal behavior did not necessarily mean an individual lacked the capacity for communicative behavior or behavior change, a movement towards the application of behaviorism to society came into play. The first reported study with behavior modification for disabilities was conducted by Fuller (1959) to treat an individual with severe intellectual disabilities. Although minimal, there was record of increased movement after using sugar-milk to produce positive reinforcement. In addition, Allyon and Michael (1959) used behavioral

techniques within an inpatient unit for individuals diagnosed with mental retardation to increase behaviors that were "socially relevant."

These behavior principles transferred to the world of autism quickly. One of the pioneers in this area was Ivar Lovaas. Lovaas initially began the basis of ABA treatment in the 1960s, attributing the majority of his success with children exhibiting social and intellectual deficits to the implementation of consistent ABA therapy, especially in the areas of generalization and maintenance. In a 1973 study, Lovaas et al. also concluded that behaviors could be generalized across settings, and could apply to a variety of different situations if done correctly (Lovaas, 1973).

Reinforcement

One of the primary components of ABA is the principle of reinforcement. Originated by Skinner in the late 1940s, reinforcement took his general term of operant conditioning and specified characteristics that would increase the likelihood that a behavior would occur in the future. An operant behavior is strengthened when it is more probable or frequent (Skinner, 1948). Simply stated, reinforcement occurs when a consequence following a behavior strengthens that behavior. For example, consider if every time a child cried, she was given a puppy. If crying increased in the future this would be considered reinforcement, because the behavior of crying has increased as puppies were delivered as a consequence.

Reinforcement can be divided into two categories: positive and negative. Both positive and negative reinforcement increase the likelihood of a behavior occurring; however, positive reinforcement involves the presentation of a stimulus after the

behavior, while negative reinforcement involves the removal of a stimulus after the behavior (Skinner, 1958). For example, if a child clapped his hands and then received a cookie and was more likely to clap his hands in the future, this would be considered positive reinforcement. The cookie was a stimulus presented after clapping, and clapping was strengthened in the future.

On the other hand, if the child was placed in an undesirable high chair and was removed from the chair after clapping his hands, and clapping was strengthened in the future, this would be considered negative reinforcement. The chair was a stimulus removed after clapping, and clapping was strengthened.

Extinction

Extinction occurs when a previously reinforced behavior no longer receives reinforcement, and as a result, the behavior is weakened. Keller and Schoenfeld (1950) describe extinction as the weakening of a behavior after reinforcement is withheld. The concept of extinction can be applied as an intervention to reduce or eliminate problem behavior. For example, if a child has experienced a history of receiving attention contingent upon hitting his peers and this aggression had strengthened, then it would be concluded that attention is serving as a reinforcer for hitting. Therefore, if the peers were to stop attending to the child when he hit, the behavior would decrease in the future. In other words, the reinforcer, attention that was previously following hitting behavior, is no longer being delivered.

Functional Communication

Functional communication training is an ABA-based intervention to reduce behaviors, specifically with children who exhibit cognitive deficits. FCT is a highly individualized approach to challenging behavior. First implemented by Carr and Durand (1985), this intervention involves prompting the individual to emit communicative behavior that is functionally-equivalent to the problem behavior. First, the function of challenging behavior is identified with a functional behavior assessment, most typically a functional analysis. Once the function of the problem behavior is identified, the individual is taught a replacement communicative behavior that allows him or her to gain access to the desired consequence. For example, if a child hits his mother, first a functional assessment would be conducted to identify the maintaining consequence (Carr & Durand, 1985). If the maintaining function of hitting is access to attention, then the child would be taught a socially-appropriate communicative response to gain attention, such as saying "look at me." The individual is able to communicate as a replacement response. As a result, the individual no longer needs to utilize the problem behavior to gain access to his wants or needs.

A high percentage of individuals diagnosed with ASD are at risk for developing problem behaviors, specifically aggression, self-injury, and property destruction. This can generally be caused by a variety of contributing factors, including environmental events that reinforce responses, biological factors, and deficits in adaptive behavior (Kurtz et al., 2011). FCT has been used specifically to target problem behaviors due to its ability to provide a simple alternative behavior of manding (i.e., requesting) to replace the previous behavior. Because the primary focus is increasing effective

communication, it often also focuses on the interfering behaviors, commonly leading to less aggression and self-injury (Chung et al., 1995).

The National Professional Development Center (2014) established 27 treatment strategies that are considered to be Evidence-Based Practices; that is, scientific research shows them to be considered effective at treating children with ASD when implemented properly. FCT is listed as one of the 27 evidence-based treatment, as well as the components that comprise it (i.e., reinforcement and extinction) (Wong et al., 2014). Kurtz et al. (2011) also established FCT as "far-exceeding criteria to be considered as a well-established treatment" for such problem behaviors after reviewing the literature that utilized FCT specifically for problem behavior, with 54 of the 80 participants (68%) exhibiting some form of self-injury (p. 298).

CHAPTER TWO

Review of the Literature

Methods

To gain a better understanding of the current literature on functional communication training to treat self-injurious behavior, this review systematically analyzed studies that implemented functional communication training to treat self-injurious behavior displayed by individuals with ASD. The purpose of the current review was to systemically review and summarize the literature in terms of participant characteristics, characteristics of the self- injurious behavior, functional communication training methodology, and study outcomes.

Search Criteria

A systematic electronic database search was conducted in the following databases: PsychINFO, Educational Resources Information Clearinghouse (ERIC), Education Research Complete, PsychARTICLES, and Psychology and Behavioral Sciences Collection. The search terms *functional communication* and *self-injury* were entered as a pair into the keyword field. Boolean Operators and truncation were implemented. Each of the 84 resulting articles were examined and each abstract was reviewed against the inclusion criteria described below. Eleven studies meeting the inclusion criteria were identified. Additionally, an ancestry search was conducted on each included study in order to identify any supplemental articles that

were not found via database search. However, no articles that met inclusion criteria were identified through the ancestry search. A final hand search through the journals in which the eleven studies were published was conducted. Specifically, a hand search was conducted in the *Journal of Applied Behavior Analysis, American Journal on Mental Retardation, Behavior Modification, The Journal of Speech and Language Pathology- Applied Behavior Analysis, Brain Injury*, and *Behavioral Disorders*, beginning the 1990 volume. No additional studies meeting the inclusion criteria were identified.

Inclusion and Exclusion Criteria

In order to be included in the review, a study must adhere to four inclusion criteria: (a) the study was published in a peer-reviewed journal; (b) participants were humans diagnosed with an intellectual or developmental disability; (c) self-injury was measured as a dependent variable; and (d) functional communication training was applied as the independent variable.

Only studies in which self-injury was measured in isolation, as opposed to being collapsed with additional challenging behavior into a larger umbrella of behaviors (e.g., "problem behavior"), were included so that the specific effects of functional communication training on self-injury could be identified. Six studies measured the effects of functional communication training on problem behaviors, which included, self-injury among others (Bowman et al., 1997; Braithwaite & Richdale, 2000; Carr & Durand, 1985; Falcomata et al., 2012; Schieltz, 2011; Sigafoos & Meikle,1996).

However, these studies were excluded from the review because it was essentially impossible to discriminate whether functional communication was having a direct impact on self-injury individually because self-injury was measured within the larger context of problem behavior that included additional topographies of behaviors (e.g., property destruction, stereotypy).

Data Extraction

Several categories of data were extracted from each of the eleven articles that met the inclusion criterion: (a) participant characteristics, (b) self-injurious behavior, (c) functional communication training, and (d) study outcomes. The participant category included the following subcategories: (a) number of participants, (b) sex, (c) age, and (d) diagnosis. The self- injurious behavior category consisted of (a) topography of the behavior, (b) functional behavior assessment methodology, and (c) function of the behavior.

Functional communication training included the following subcategories: (a) setting, (b) functional communicative response, and (c) response to problem behavior. The final category, study outcomes, contained the following contributing categories: (a) study outcomes, (b) generalization outcomes, (c) maintenance outcomes, and (d) social validity outcomes.

Results

Eleven studies were ultimately identified for the literature review. Table 2.1 provides a brief summary to cover the primary components of each.

Table 2.1 Characteristics of Studies Included in Literature Review

Study	Participants	Functional Communicative Response (FCR)	FCT Components	Study Outcomes
Bird et al. (1989)	Male, 27 years; autism and ID	One FCR evaluated: gesture handing therapist a token	alternative mand instruction/differential reinforcement (DRO and DRI)/SIB on extinction	positive
Casey & Merical (2006)	Male, 11 years, autism	Two FCRs evaluated: (a) vocalization or (b) touching post-its	alternative mand instruction	positive
Danov et al. (2010)	Male, 2 years, autism	Two FCRs evaluated: (a) vocalization, or (b)picture cards	alternative mand instruction/differential reinforcement/SIB on extinction	positive
Day et al. (1994)	Female, 34 years, severe ID, epilepsy	One FCR evaluated: card with the word "help" on it	alternative mand instruction/differential reinforcement/punishment for SIB	positive
Derby et al. (1998)	Female, 12 years, ID, visual impairment	One FCR evaluated: picture cards	alternative mand instruction	positive
Harding et al. (2005)	Male, 16 months, DD Female, 5 years, seizure disorder, microencephaly, CP, hearing impairment, visual impairment, ID	One FCR evaluated: electronic device	alternative mand instruction/differential reinforcement/punishment for SIB	positive
Kahng	Male, 50 years	One FCR	alternative mand	positive

Study	Participants	Functional Communicative Response (FCR)	FCT Components	Study Outcomes
Iwata et al. (1997)	ID and TB Male, 45 years, ID; Female, 29 years, ID	evaluated: vocal or sign language (varied by participant)	instruction/differential reinforcement	
Kurtz et al. (2003)	Sex not specified 3 years, mild ID 3 years, CP 2 years, DD 2 years, DD 2 years, paraneuroplastic syndrome 2 years, postasphyxial encephalopathy 4 years, cardio-facia-cutaneous syndrome 4 years, FAS 2 years, ADHD neonatal abstinence syndrome 2 years, seizure disorder 2 years, MR 2 years, TBI 2 years, chromosome 9 and 13 translocation	not specified	alternative mand instruction/differential reinforcement (DRO)/SIB on extinction/punishment for SIB	positive
Moore (2010)	Male, 18 months; right hemiparesis, visual impairment, epilepsy	electronic device	alternative mand instruction/differential reinforcement/SIB on extinction	positive

Study	Participants	Functional Communicative Response (FCR)	FCT Components	Study Outcomes
Wacker et al. (1990)	Male, 7 years; autism, ID, visual impairment, epilepsy	One FCR evaluated: gesture	alternative mand instruction/differential reinforcement/SIB on extinction/punishment for SIB	positive
Worsdell & Iwata et al. (2000)	Male, 33 years, ID Male, 37 years, ID Female, 44 years, ID Female, 31 years, ID Female, 29 years, ID	Each individual had an individualized mode of communication, consisting of; gesture, picture cards, and handing plate to therapist as mand	alternative mand instruction/differential reinforcement/SIB on extinction	positive

Note: The following abbreviations have been used for the common diagnoses identified throughout the literature accompanied by the full disorder title, respectively: ID (intellectual disability), CP (cerebral palsy), DD (developmental delays), TB (tuberous sclerosis), FAS (fetal alcohol syndrome), and TBI (traumatic brain injury).

Participants

Overall, 31 participants were involved in the relevant studies. Among the participants, 31% (n = 10) were male and 22% (n = 7) were female. Sex was not reported for the remaining 44% (n = 14) of participants.

Participant ages spanned from 10 months to 50 years, and were represented as follows: infant and toddler (ages 0-2), 38% (n=13); early childhood (ages 3-5), 19% (n=5); school age (ages 6-12), 9% (n=3); adolescence (ages 13-18), 0% (n=0); early adulthood (ages 19-22), 0% (n=0); and adulthood (ages 22 and up), 34% (n=10) A wide array of diagnoses existed among the participants, including: intellectual disability (previously referred to as mental retardation) (66%, n = 21), non-specified developmental

delay (19%; n=6), epilepsy (19%; n=6), visual impairment (16%; n=5), autism (13%; n=4) and cerebral palsy (6%; n=2). The following disorders occurred among one participant each: hearing impairment, neonatal abstinence disorder, fetal alcohol syndrome, microcephaly, cardio-facia-cutaneous syndrome, severe brain trauma, chromosome 9 and 13 translocation, paraneuroplastic syndrome, postasphyxial encephalopathy, right hemiparesis, ADHD, and tuberous sclerosis.

Self-Injurious Behavior

Across the studies reviewed, there were several topographies of self-injury demonstrated by the participants. The topographies included: hitting self, 25% (n=8); head banging, 19% (n= 6); scratching self, 6% (n=2); eye gouging/pressing, 13% (n=4); biting self, 19 % (n=6); and hair pulling, 6% (n=2). Other additional self- injurious behaviors specified to one participant were kneeing face, arm banging, hand mouthing, and skin picking.

Function behavior assessment methodology. The function of behavior was evaluated for all of the eleven studies within the literature reviewed. Ten of the eleven conducted full functional analyses to determine the function of behavior. The remaining study, Bird et al. (1989), utilized the Motivation Assessment Scale (Durand& Crimmins, 1983) in order to analyze the degree of motivation to demonstrate maladaptive behavior produced by each function through a 16-item questionnaire.

Function of self-injury. A variety of functions maintaining self-injury were identified across the included studies. Attention was maintaining self-injurious behavior in 31% (n=10) of participants. Similarly, escape maintained self-injury in another 22% (n=7). The most common maintaining consequence was access to tangibles, identified in

47% (n=15) of participants. Functional analyses results were undifferentiated in another 19% (n=6) of participants. It should be noted some functional analyses concluded that self-injurious behavior was maintained by multiple functions. No participants' self-injurious behavior was maintained by automatic reinforcement.

Functional Communication Training

Setting. Functional communication training was carried out in a variety of settings. The participant's home (36%, n=4) and clinic setting (36%, n=4) were the most frequently implemented settings. A school setting was also used for three of the studies (27%) and a residential home was utilized for the remaining study (9%).

Functional communicative response. The forms of communication selected for the alternative functional communicative response varied based upon the participant's level of functioning and other factors. The most commonly implemented topography of communication was sign language and/or gestures, which was implemented for seven participants (22%). For example, Bird et al. (1989) taught the participant to emit the manual sign for "break" in order to receive a short break from the demand presented. The participant was immediately provided time away from the work table contingent upon the appropriate sign, decreasing his self-injury to less than five incidents per week in the final two-week treatment period.

Another three participants (9%) utilized vocalizations as the alternative functional communicative response. For example, Casey and Merical (2006) taught the participant to state "I need a break." Contingent upon emitting that response, the participant was allowed to leave the task (p. 48).

Five participants (16%) utilized a photo or picture card system. For example, Danov and colleagues (2010) developed a communication board that consisted of an 8" by 11" piece of cardboard. Twelve two-inch picture cards consisting of a Microsoft Clipart representation of desired items was placed on the communication board, affixed with Velcro. The participant was taught to remove the picture card of the desired item and place it in the experimenter's hand. Contingent upon placing the card in the experimenter's hand, the participant was given access to that time.

Another three participants (9%) taught the participants to use an electronic communication device, such was the case in Harding et al. (2005). Participants were taught to utilize a speech-generating device that, when touched, emitted a pre-recorded message that solicited their mom's attention (e.g., "Mom, let's play"). Contingent upon emitting the message from the speech-generating device, the participants were given access to preferred toys and mom's attention.

Additionally, three participants (9%) also utilized objects as a means of communication, including a small token, a post-it note, and a plate. For example, Worsdell et al. (2010) taught one participant to hand the therapist a plate signal that she would like to receive preferred foods. It should be noted that some studies implemented two or more topographies of communication simultaneously and that one study (Kurtz et al., 2003) did not disclose the functional communicative response.

Response to problem behavior. The exact procedures that constitute FCT can be difficult to pinpoint because FCT is commonly implemented as a component of a treatment package with additional intervention strategies (Hagopian, Fisher, Sullivan, Acquisto, & LeBlanc, 1998). Specifically, it has been well noted that among the FCT

literature, a great deal of variability exists with respect to the consequences delivered for problem behavior (Hagopian et al., 1998). Common procedures include extinction and punishment.

Three of the eleven studies (27%) implemented punishment contingent on self-injurious behavior. Punishment consisted of the presentation of an undesired task or removal from a desired setting contingent upon self-injurious behavior. For example, Bird et al. (1989) implemented punishment by presenting the participant with difficult demands for contingent upon the display SIB.

Another six studies (55%) placed self-injurious behavior on extinction during FCT. For example, Moore et al. (2010) provided ten seconds of maternal attention contingent upon the display of the functional communicative response, but self-injury previously maintained by attention no longer no programmed consequences.

Kurtz and colleagues (2003) applied both extinction and positive punishment principles that were paired in order to compile a treatment package that would decrease self-injury as effectively as possible. However, the differences between both principles were not analyzed and compared for the purposes of the study.

Casey and Merical did not implement any form of punishment or extinction, but purely focused on reinforcing the communicative response to identify affects. They taught the participant to request a break both vocally and by touching a notecard that said "I want a break." Following the teaching trials, appropriate communicative behaviors were reinforced with escape from the task, yet self-injury also resulted in escaping the demand. Results found that teaching the communicative response independent of extinction or punishment still yielded results in decreased self-injury.

Study Outcomes

Study outcomes were rated as positive, negative, or mixed. Studies were rated as positive if all measured topographies of self-injury were reduced across all participants. Studies were rated as negative if no topographies of self-injury were reduced across all participants. Studies were rated as mixed if some topographies of SIB were reduced for some participants, but not all or if some participants improved, but others did not. Of the eleven studies evaluated within the literature review, all of them demonstrated positive results.

It should be noted that the purpose of this literature review is to analyze the effects of FCT on self-injury. As a result, improvement of communication skills was not considered in determining if FCT outcomes were considered positive, negative, or mixed.

Generalization outcomes. Generalization was reported within two of the eleven studies as well (18%). Moore (2010) reported generalization from the initial discriminative stimulus of "mom" in order to request attention, to the father and other individuals based upon parent report from the mother. Additionally, Wacker et al. (1990) reported evidence of response generalization to new topographies manding responses for desired items from different therapists. However, this information was based upon report; no formal data were collected to measure response generalization.

Maintenance outcomes. Two of the eleven studies (18%) evaluated the maintenance of results. Day et al. (1994) collected data one year after the research was completed and found that self-injury remained absent. Additionally, Casey and Merical (2006) completed several sessions of data collection at 5 months, one year, and two year intervals following the study and revealed similar results, with self-injury remaining at

zero for each maintenance session. It should be noted that there was no data collected on maintenance of additional dependent variables, such as communication.

Social validity outcomes. Out of the eleven studies reviewed, three (27%) evaluated social validity. Harding et al. (2005) received reports from both parents stating that they found the implementation of FCT acceptable. Moore (2010) reported the participant's mother expressed concern at the implementation of FCT, explaining that she felt uneasy allowing him to intensely cry throughout the functional analysis, but also reported that she still continued to have confidence in the behavioral process. Kurtz et al. (2003) also took a unique approach with parents implementing FCT procures. After the completion of the study, the parents reported that they had a better understanding of behavioral procedures.

Discussion

Conclusions

Several prominent themes were identified in this literature. First, teaching a replacement communicative behavior, regardless of the form or topography, reduced self-injury to a significant degree across studies and participants. Additionally, it is notable that sign language was the most common replacement communicative behavior, as opposed to vocal communication, pictures, or electronic devices. However, there are still several gaps in effectiveness of functional communication that need to be filled; specifically, which modes of communication are most effective in reducing self-injury. Preference of response topography could have a significant impact for the individuals, yet

there is little research on this area to evaluate if a variance in mode could allow for quicker adaption of the alternative behavior.

Second, the most common topography of self-injury targeted in the studies was hitting self, head banging, and biting self. Seeing as these are some of the more health-threatening forms of self-injury, it is not surprising that they were highly targeted. However, more mild forms of self-injury such as hair-pulling or scratching were hardly addressed; this may be considered as a gap in the literature.

Finally, FCT was successfully implemented across all socially-mediated functions of behavior (i.e., access to attention, access to tangibles, and escape from demands). It appears that communication in itself would essentially address the behavior regardless of whether it was targeting the specific function.

Limitations in the Literature Review

This literature review does present some limitations. The most prominent limitation was the limited number of studies that measured SIB in isolation, as opposed to measuring SIB in a larger umbrella of problem behavior. A large number of articles providing evidence of a decrease in SIB combined with aggression and/or property destruction were eliminated due to the collapsed topography defining "problem behavior" and broadening self-injury too widely to be accurately analyzed. With this said, there may have been some relevant results eliminated due to this addition to inclusion criteria.

Future Research

Several questions surrounding functional communication training and its role in reducing self-injury still remain. First, there is a lack of guidance regarding the selection of the functional communicative response topography. A variety of topographies, including vocalizations, electronic devices, picture cards, and gestures, were implemented across studies. However, only one compared the effectiveness of two topographies. Moreover, only one study evaluated participant preference for topography of communicative behavior. Danov (2010) found that the participant engaged in relatively higher levels of independent picture card use, but never independently emitted vocalizations. Caregivers and practitioners need guidance in terms of how to select the most effective alternative communication, yet the literature does not currently provide such guidance.

Another gap in the literature is that the age range of participants in this literature review included two marked gaps. Specifically, very few participants, ages three to five years, were included across the studies. It seems that a younger age would be a paramount time for implementing FCT because not only is this the age span when communication is developing rapidly but also most self-injury manifest itself before the age of five years (Kurtz et al., 2003, p.205). Additionally, there no participants ages 13 to 22 years included in this review. This is particularly problematic because it is within this age span that individuals are frequently transitioned to adult programs and residential facilities. The presence of self-injury may limit community resource options; therefore, it is critical to ensure that FCT can effectively reduce SIB within this population of individuals as well.

Finally, there was an overall lack of generalization and maintenance reported for the literature as a whole, with two studies (17%) reporting generalization and one study (8%) reporting maintenance. This naturally brings into question whether these replacement behaviors were effective in a variety of settings, or whether the decrease in SIB was short-lived.

CHAPTER THREE

Methods

Participants

Both participants were selected through an ABA clinic serving children with developmental disabilities. In order to participate in this study, the child must have been between the ages of two and twelve years. Additionally, the child had to have demonstrated mild self-injury that did not pose an imminent threat to his safety, such as self-scratching without breaking the skin, teeth grinding, self-hitting without enough force to cause tissue damage, hair pulling with minimal hair loss and no tissue damage, head hitting while wearing a protective helmet, and head banging while wearing a protective helmet. The following behaviors were considered unsafe to be included in this study: head banging without protective padding and/or that had previously led to head injury, self-biting or self-scratching that had broken the skin, hair pulling that had caused tissue damage, and eye gouging.

Two boys were selected to participate in this study. Aidan was an eight-year old male diagnosed with ASD. He had no functional vocal communication, but demonstrated non- functional vocalizations, such as yelling. He utilized an iPad™ with the communication application Proloquo2Go, primarily for manding purposes. Aidan's self-injury was defined as (a) making any forceful contact between his wrist(s) and an object, generally the wall, table or door, and (b) making forceful contact with his chin to any object, most commonly the protective blocking equipment. Brandon was a five-year old male diagnosed with ASD. Brandon communicated vocally; he spoke in full sentences

and had an age-appropriate repertoire of words; however, he rarely utilized functional speech when exhibiting problem behavior.

Brandon's self-injury was defined as (a) any contact made between his head and another object in a backwards or forwards motion, (b) pinching of his own skin with the thumb and index finger, and (c) any forceful contact made between the heel of one or both feet with an object, most commonly the walls or ground, when his legs are straightened out horizontally. Before the intervention began, both participants were given fine-motor tasks, such as beading and holding thin items, as well as several motor imitation directions, and observed in order to confirm that they were both physically able to effectively utilize both modalities during the study.

Setting

The study took place in an ABA clinic that partners with the university for research and training opportunities. Each session was administered in an individual direct therapy room, consisting of two chairs, and a small desk. Padding was applied to corners and hard surfaces when deemed necessary based upon the severity of the participants' problem behavior. Session- specific materials were brought to the room from their designated storage location. The participant was seated in a chair for the duration of the session facing the primary experimenter delivering the intervention demands and reinforcement.

Materials

Three highly preferred items were identified per participant via a paired preference assessment (Fisher et al., 1992). Additionally, each participant utilized two augmentative communication devices: a picture card and an electronic speech generating device. The picture card was a 6-inch by 6-inch color photograph of the exact item that the child desired with a solid background. The speech generating device was a BIGmack one-button communication device. When activated, the BIGmack would emit a pre-recorded message stating the name of the item.

Measurement

Data Collection

Sessions were five minutes in duration. Observation data were collected by trained graduate students via pencil and paper. Self-injury and manding with the functional communicative response were measured with a 10-second partial recording system. Self-injury for each session was calculated by dividing the number of intervals that self-injury was displayed by the total number of intervals, then multiplying by 100%. In cases in which self-injurious behavior was a serious threat to the child's safety, that behavior was blocked, but the self-injury attempt was counted during data collection. In other words, contact was not necessary for the behavior to be considered self-injury. Additionally, the presence of manding was calculated in the same fashion. See Appendix B, Data Sheet B.1 for an example data sheet for Experiment One.

For Experiment Two, the functional communicative response preference was also recorded. Data regarding the functional communicative response emitted was collected in

terms of percentage of opportunities presented to respond. Each session, there were approximately 10- 15 opportunities to respond, and the percentage of preference for each modality was calculated by dividing the amount of times the modality was selected by the total number of times an independent communicative response occurred, then multiplying by 100%. The percentage of intervals that each mode was selected was recorded. See Appendix B, Data Sheet B.2 and B.3 for an example data sheet for Experiment One.

Interobserver Agreement

In order to ensure reliable data collection, all graduate student data collectors were trained prior to the start of the study. The training consisted of providing an operational definition of the target behaviors and the opportunity to practice data collection through the use of a role play, with experimenters acting as participants. Role play continued until the data collectors demonstrate the ability to collect data with 90% interobserver agreement with the lead researcher across at least two consecutive sessions.

Procedures

The study consisted of three phases, identified as (a) Pre-experimental, (b) Experiment One, and (c) Experiment Two. The pre-experimental phase incorporated a parent interview, a direct preference assessment and a functional analysis to identify the function of the problem behavior. Experiment One consisted of implementation of FCT with two functional communicative response topographies until mastery was obtained for both functional communicative response topographies. Experiment Two evaluated the participant's preference for mode of communication.

Pre-experimental Phase

Parent interview. An informal, open-ended parent interview was conducted to identify self- injurious behaviors occurring most frequently. During this time, the parents were also asked to identity preferred toys and items that could be utilized in the preference assessment.

Preference assessment. The purpose of a preference assessment was to identify stimuli most preferred for an individual. A forced-choice preference assessment was implemented according to the procedures outlined by Fisher et al. (1992). A total of five items identified via parent and therapist interview were included in the assessment. The highest preferred stimulus was utilized during functional communication training.

Functional analysis. A functional analysis was conducted in order to identify the function of the self-injurious behavior. The functional analysis was implemented according to procedures outlined by Iwata et al. (1994). Each child was presented with four of the conditions, (a) tangible, (b) escape, (c) attention, and (d) play. All sessions were 5 minutes in duration.

During the tangible condition, the most highly reinforcing item was presented to the child. After 10 seconds, the researcher removed the toy. Contingent upon self- injury, the toy was returned for 15 seconds. The purpose of this condition was to determine if self-injurious behavior was maintained by access to tangibles.

For the escape condition, a work task was presented to the participant. The selected task was one in which the participant could typically complete without assistance, but did not appear to be preferred. Tasks were selected in collaboration with

the participant's therapist and parent; for Aidan, it was a variety of inset puzzles, and for Brandon, several fine motor activities that required putting the designated amount of clothespins onto the appropriate card, as well as beading, was used. Varying levels of prompting were used throughout the condition in order to complete the task (verbal, gestural, modeling, and physical). If the child exhibited self-injurious behavior during the work task, the task was removed for 15 seconds. The purpose of this condition was to determine if self-injurious behavior was maintained by escape from demands.

The attention condition entailed the participant receiving a mildly preferred item while the experimenter was completing a task within a close proximity. The experimenter told the child to play quietly so the experimenter could finish his/her work, implying that experimenter attention would be withheld. If self-injury was exhibited, then the therapist would attend to the participant for 15 seconds with a verbal acknowledgment of the behavior (for example, "Don't do that!" or "You'll hurt yourself!"). The purpose of this condition was to determine if self- injurious behavior was maintained by access to attention.

The play condition served as a control condition for the functional assessment. The participant had free access to the preferred toys within the room, and no work tasks were presented. The therapist was present in the room, and occasional physical contact or interaction took place upon appropriate behavior. Toys were periodically offered to the child, but no demands were presented. This was to get an approximate of the average frequency in which self-injury was occurring without the presence of any other contributing environment factors or functions.

The results of the functional analysis were analyzed with a multi-element design, essentially demonstrating response differentiation between alternating conditions as a means of experimental control and relation between variables (Kennedy, 2005). The rates of self-injurious behaviors in the tangible, escape, and attention conditions were compared to the rate of self- injurious behavior in the play condition. When self-injurious behavior elevated in any test condition (i.e., tangible, escape, or attention) relative to the play condition, it was concluded that self-injurious behavior was maintained by the condition-specific reinforcer. The results of both participants' functional analyses indicate that self-injury was maintained by access to tangibles.

Experiment One

The purpose of Experiment One was to teach the participant to use two functional communication response topographies to mand for desired reinforcers. All sessions were 5 minutes in length.

Baseline. Baseline sessions were similar to the tangible condition of the functional analysis. The participant was given access to a tangible for 10 seconds at the beginning of the session, then the item was removed but remained in sight. Contingent upon self-injury, the stimulus was returned to the participant for 15 seconds.

FCT with picture cards. Before the session began, a laminated 6-inch by 6-inch card containing a photograph of the highest preferred stimulus identified in the preference assessment was placed on the table. To begin the session, the experimenter gave the preferred tangible to the participant for 10 seconds. Immediately after removing the toy,

progressive time delay was implemented to prompt the participant to hand the picture card to the experimenter. Contingent upon handing the card to the experimenter, the experimenter returned the tangible item to the participant for 15 seconds. All self-injury and other challenging behaviors were ignored.

FCT with SGD. Before the session began, the BIGmack® speech generating device, was placed on the table. To begin the session, the experimenter gave the preferred tangible to the participant for 10 seconds. Immediately after removing the toy, progressive time delay was implemented to prompt the participant to press the BIGmack. Contingent upon depressing the BIGmack with enough force to emit the message, the experimenter returned the tangible item to the participant for 15 seconds. All self-injury and other challenging behaviors were ignored.

Experimental design. A multielement design embedded within an ABAB design was implemented to evaluate the effects of FCT with both functional communicative responses on self-injury. Each mode of communication was taught in alternating sessions until reaching a mastery criterion of decreasing self-injurious behavior to 10% of intervals or less across three consecutive sessions.

Experiment Two

In Experiment Two, both modes of communication were presented simultaneously on the table, equal distance from the participant. To begin the session, the experimenter gave the preferred tangible to the participant for 10 seconds and then removed the toy. Contingent upon independent use of either functional communicative

response topography, the experimenter returned the tangible item to the participant for 15 seconds. All self-injury and other challenging behaviors were ignored.

The purpose of this assessment was to determine the participant's preferred communicative response topography, determined by the amount of times in which each functional communicative response was selected, divided by the total amount of responses.

Treatment Integrity

In order to evaluate the integrity with which treatment procedures were able to be implemented, a treatment integrity evaluation was utilized. A checklist of experimenter procedures was utilized to measure treatment fidelity for Experiment One and Experiment Two. Each checklist outlined the specific procedures the experimenter should follow for each condition associated with each experimental phase. See Appendix B, Data Sheet B.3 for the treatment fidelity checklist for Experiment One and Data Sheet B.4 for the treatment fidelity checklist for Experiment Two.

CHAPTER FOUR

Results

Experiment One

Functional Analyses

The functional analysis revealed elevated levels of self-injury during the tangible condition, relative to play, indicating a tangible function of behavior for both participants. In the escape condition, Aidan displayed self-injury for a mean of 4% of intervals (range, 0% to 10%). In the attention condition, Aidan displayed self-injury for a mean 18% of intervals (range, 7% and 30%). In the play condition, Aidan demonstrated self-injury for a mean of 13% (range, 7% to 17%). During the tangible condition, Aidan engaged in self-injurious behavior upon removal of the preferred tangible item for a mean of 38% of intervals (range, 30 to 53%).

For Brandon, the mean amount of intervals that self-injury was displayed in the demand condition was 16% (range, 0% to 53%). For the attention condition, the mean amount of intervals that self-injury was demonstrated was 1.4% (range, 0% to 7%). In the play condition, Brandon displayed self-injury for a mean of 3% (range, 0% to 10%). Brandon similarly demonstrated self-injury during tangible conditions with a mean of 34.8% of intervals (range 7% to 67%). Refer to Appendix A for figures displaying these results.

Baseline

Baseline sessions were conducted until a consistent trend of responding was established for each participant. The data for each participant appears in a line graph for visual analysis of the results. During baseline, Aidan displayed self-injury a mean of 48% of intervals (range, 40- 57%). On the other hand, Aidan never displayed the functional communicative response during bassline. Brandon displayed self-injury a mean of 43% of intervals (range, 20-67%). Similar to Aidan, Brandon never emitted the functional communicative response during baseline.

Teaching Trials

Both communicative modalities were taught to each of the three participants in alternating sessions, in order to prevent the development of a preference or growing accustomed to a specific pattern of learning. Both participants began with a speech-generating device session. The sessions were then alternated; for example, Aidan was exposed one five-minute session in which he was taught to request with the speech-generating device then the next five-minute session he was taught how to use the picture card.

Both participants emitted less self-injury in the speech-generating device teaching trials, relative to the picture card teaching trials. Aidan displayed self-injury a mean 19.6% of intervals during the picture card condition, but a mean of 4% of intervals in the speech-generating device conditions. Brandon display self-injury a mean of 10% of intervals during the picture card condition and a mean of 4.3% of intervals during in the speech-generating device condition.

Similar patterns were identified for communication; independent display of the functional communicative response was higher during the speech-generating device condition, relative to the picture condition, for both participants. Aidan never independently emitted the functional communicative response during the picture card condition; on the other hand, he independently emitted the functional communicative response a mean of 52% of intervals during the speech- generating device condition. Similarly, Brandon independently emitted the functional communicative response a mean of 35.4% of intervals during the picture card condition; on the other hand, he independently emitted the functional communicative response a mean of 61% of intervals during the speech-generating device condition.

The mastery criterion to terminate functional communication training was demonstrating self-injurious behavior for ten percent or less of the intervals within a session over three consecutive sessions. Aidan met this mastery criterion with picture cards within six sessions and met the mastery criterion with the speech-generating device within three sessions. Brandon met this mastery criterion with picture cards within five sessions and met the mastery criterion with the speech-generating device within three sessions.

Experiment Two

Modality Preference Assessment

Both participants demonstrated a preference for the speech-generating device in the communication modality. Aidan chose the speech-generating device for 100% of the opportunities to choose a modality was presented within the six preference sessions,

approximately 10-15 opportunities per session. He never chose the picture card and demonstrated self-injury on a mean rate of 1.7% throughout the preference sessions (range of 0- 10%). Brandon chose the speech-generating device as opposed to the picture card for 74% of the times that the option to choose a modality was presented, while exhibiting a mean rate of zero self-injurious behaviors throughout the preference sessions, as self-injurious behavior was not demonstrated during these sessions.

Interobserver Agreement

Two data collectors independently recorded data for 54% of the sessions. Interobserver agreement was calculated by dividing the number of intervals with agreement by the total number of intervals (agreement + disagreement), then multiplying this number by 100%. IOA was 99.4% across participants (93-100%).

Treatment Fidelity

An additional experimenter was present in 27% of all experimental sessions to measure treatment fidelity. Treatment fidelity was 95% across participants (75-100%).

CHAPTER FIVE

Discussion

Conclusions

Experiment One

Teaching Trials. Across both participants, the rate of self-injurious behavior reduced rapidly and both participants met the criterion to terminate training within the first few teaching trials for both functional communicative response topographies. These results are consistent with the majority of current literature evaluating the impact of functional communication, across multiple topographies on the presence of self-injury beginning with the initial Carr and Durand (1985) study. The rationale for this phenomenon is the communicative response essentially replaces the problem behavior, because when an individual can more effectively communicate in a simplified way, then the communicative response will become the more preferred method to access the desired consequence. The speech-generating device reduced self-injury in both individuals to zero, similar to the results of Moore et al. (2010), that reduced self-injury down to 13% when pressing the speech-generating device was presented with ten seconds of reinforcement for the corresponding to the reinforcement that was previously maintaining challenging behavior. In this study, the picture card also resulted in reducing the self-injury to zero for both participants, as did a similar intervention in Danov et al. (2010).

The speech- generating device was mastered in a shorter amount of sessions than the picture card.

The results for both participants reflected a greater ease in learning how to independently utilize the speech-generating device as opposed to the picture card. Although there have not been any previous studies that specifically compared the rate of self-injury reduction between the two modalities, Danov et al. (2010) saw self- injury reduce to zero within three sessions for the picture card, whereas Moore et al. (2010) never reached zero levels, but reached its low of 13% of intervals.

There are several explanations as to why the participants met the mastery criterion faster with the speech generating devices relative to the picture card, with a few prominent ones proposing the possibility that preference could influence acquisition rate, the idea that response effort may play a role in preference, and the potentially reinforcing effects of auditory feedback. One explanation is modality preference influences acquisition. Studies have found that children acquire skills more quickly if they able to use learning strategies that utilize the most preferred dimensions of completing a task (Rollins & Castle, 1973). Similarly, it may be that preferred dimensions in topography of modality provide dimensions that are more reinforcing, and therefore increases the amount of usage, potentially increasing the motivation to use the more reinforcing modality and portraying it as preferred within the study. With that, the use of technological means of learning has been studied and proved to be motivating for children to acquire tasks (Kozma & Anderson, 2002).

Although a simple form of technology, the speech- generating device may have held more value for learning to utilize it, as it was more technological than the picture card.

The current study also reflected results that indicated picture cards required more effort and were therefore less preferred, contradicting results of the Danov et al. (2010) study. The differentiation in the results of the current study in comparison to previous studies could be due to a variety of reasons. One possible explanation is that, although the picture card was preferred in comparison to vocalizations in the Danov et al. (2010) study, pressing the speech-generating device and emitting sound without the effort of creating the appropriate vocal approximations and coordinating intonation was a less effortful response, and therefore more meaningful to the participant. There is a possibility that not only was it perhaps physically less effort to lightly press as opposed to picking up a thin card and placing it in the designated location, but it was also mentally less taxing. There were several sessions where both participants would be looking at the tangible item being removed and press the speech-generating device without looking at the actual device. In addition, there were several procedural differences with the Danov et al. (2010) study, as only one participant was used, and he only demonstrated a high tangible function in the functional analysis, with all other conditions remaining very low throughout. Not only that, but the previous study taught the conditions differently, as the picture conditions offered a variety of picture card options displayed visually, with the participant having previous experience scanning and discriminating the cards in order to mand. Due to these procedural differences, choosing the picture cards more frequently could be explained due to previous experience that was interpreted as preference, or the greater variety of options that the picture cards prompted more easily than verbally requesting an abstract item.

Another reasonable explanation is that the speech-generating device requires less of a social interaction, as the picture card conditions required placing the card in the experimenter's hand, when the speech-generating device was just pressing a device as an independent task. However, although this explanation would be reasonable in accordance with the diagnostic criteria for Autism, Aidan also demonstrated an attention function for behavior, thus meaning that this explanation would indicate a preference for this picture card. Therefore, because he demonstrated a significant preference towards the speech-generating device, the evidence may contradict the social interaction theory.

Experiment Two

Modality Preference Assessment. Both participants showed a preference towards the speech-generating device and selected it more frequently than the picture card, as Experiment One initially reflected. Self-injury remained below 10% for Aidan and at zero for Brandon, possibly indicating that the speech-generating device characteristics, such as ease of usage and the auditory feature, played a role in communication choice. On several occasions, both participants attempted to put the speech-generating device speaker to their ears in an attempt to listen to the mand, indicating that there may have been reinforcing value in hearing the request. Additionally, following the auditory output of the speech generating device, Brandon occasionally vocalized the response immediately upon hearing it. The activation of two modalities concurrently could potentially hold some learning value as well, as multiple modalities have shown to be beneficial to enhance manding skills in the past (Harding et al., 2009). Providing

additional cues through the use of auditory or visual stimuli in other modalities can enhance the teaching process and clarify the item that will provide reinforcement if appropriately requested. Additionally, the reduction of problem behavior, regardless of the modality used, may create a history of reinforcement that could lead the individual to utilize communicative responses of alternative modalities in the future. Few studies have touched on speech-generating devices being implemented as a form or communication and self-injury reduction, as the literature applied the speech- generating device modality in only 9% of participants throughout the studies included in the literature review. In the studies that did implement a speech-generating device, authors noted the selection was based on characteristics of motor movement and control displayed by the participant, as was the case with Moore et al. (2010). Because the participant was able to raise and lower his hand, the speech-generating device allowed him to communicate with minimal fine-motor functioning. Although this is a reasonable recommendation, the simplicity of the device may be valuable to physically capable children as well. Past research has indicated that there is a potential correlation between the amount of response effort required to complete the mand and the level of preference; therefore, if the participant does not have to physically do as much work, he or she will be more likely to use the communication modality (Shabani, Carr, & Petursdottir, 2009). When attempting to reduce dangerous behaviors such as self-injury where replacing the behavior as quickly and efficiently as possible is a priority, a simple modality, such as the speech-generating device, may be the most valuable intervention.

Although a speech-generating device was the preferred modality, general limitations of the use of such a device should still be considered. One such limitation is

the limit of responses that can be programmed at one time. The speech-generating device used for the current study only had one button that emitted one message, whereas some others may have several buttons simultaneously available. However, with any speech-generating device, a finite number of functional communicative responses can be programmed and available at any moment because each button must contain some physical space on the machine. Considering the machine must be portable and user-friendly, this limits the number of buttons that could be available. On the other hand, picture systems may contain more responses in a smaller physical space. However, the number of picture cards that could be functionally utilized is not limitless. In fact, one must also consider portability and user-friendliness, but must also consider the ability of a word to be represented by a photograph. In other words, although a stack of cards may contain less physical space than a speech-generating device with an equal number of buttons as cards, the stack must remain small enough to be portable. Additionally, too many picture cards would be far from user-friendly as an individual may need to scroll through all of the cards to find the desired words. It is also important to note that technology and iPad usage has made communication systems more readily available in the form of tablet applications. The designation of preference may indicate a more successful system.

The findings of Experiment Two offer valuable insight for clinicians on children with ASD that may struggle to communicate or verbalize needs and wants when encountering problem behavior. A preference in communication modality may provide individuals with the tools they need to help express themselves in order to avoid frustration, and therefore lead to a significant decrease in self-injury. The most simplifies,

preferred approach can serve as a liaison to enhance communication and teach individuals coping skills before they utilize problem behavior.

Limitations of the Study

There were several limitations to the current study. First, the response effort associated with the two functional communicative response modalities may have influenced preference. Physically, the participants were required to lift the picture card and hand it to the researcher, whereas the speech-generating device required lightly pressing down. If the participant was only required to touch the picture as opposed to hand it to the experimenter, the results may have reflected a different preference.

Second, the study included only two participants; therefore, external validity is limited. A larger number of participants may have resulted in more variability for functional communicative response modality preference. The final limitation is that functional communication training only addressed one function of self-injury. Functional analyses of both participants indicated two potential consequences maintaining self-injury. Results of Brandon's functional analysis indicated that self-injury was also maintained, in part, by escape from demands. Similarly, Aidan's functional analysis indicated self-injury was also maintained, in part, by access to attention. Although FCT was markedly reduced during FCT, it was not completely eliminated. Remaining self-injury may have persisted due to these functions not being addressed. Additionally, the differing ages of the participants could have played a role. Although the skills they demonstrated throughout the assessment indicated potentially similar fine-motor abilities, the cognitive functioning of each was not specifically defined. Therefore, there could

have been different cognitive stages for each participant that had an influence on the reinforcing characteristics to designate the preference, as well as the degree of understanding they had for the communicative modalities.

Future Research

Future research in communication modality preference has a variety of potential tangents to further reduce problem behavior in individuals with ASD and other intellectual disabilities.

One area of possible research is to examine what qualities of the speech-generating device made it more reinforcing, or preferred, for the participants in the current study; specifically, the auditory components. There were several times that both participants showed interest in the auditory output, so further research could determine if the auditory component was the determinant in preference, and why.

If the preference conditions were reversed and the preference was re-presented after a temporary extinction through trials resembling baseline, results and preferences may differ. Similarly, further research could evaluate resurgence and whether the removal of the most preferred modality would result in the reoccurrence of self-injury, or the use of the lesser preferred modality in order to maintain communication through a previously mastered modality. This could be incredibly valuable from a clinician perspective in deciding whether to teach individuals exhibiting self-injury several communication modalities in order to create an opportunity for overall reduction of problem behavior due to the knowledge of several communication strategies, or if it

would be in the best interest of the child to identify and target the most preferred modality for most efficient results.

Incorporating the opportunity to request multiple items could also offer information on whether problem behavior is best eliminated by targeting the items that create the most challenging behavior, or if the variety lessens frustration because of frequent changes in preferences. Communication modalities should continue to be utilized in a variety of ways to decrease challenging behaviors and increase communication for individuals that are unable to efficiently express themselves in their most preferred means of doing so.

APPENDICES

APPENDIX A

Figures

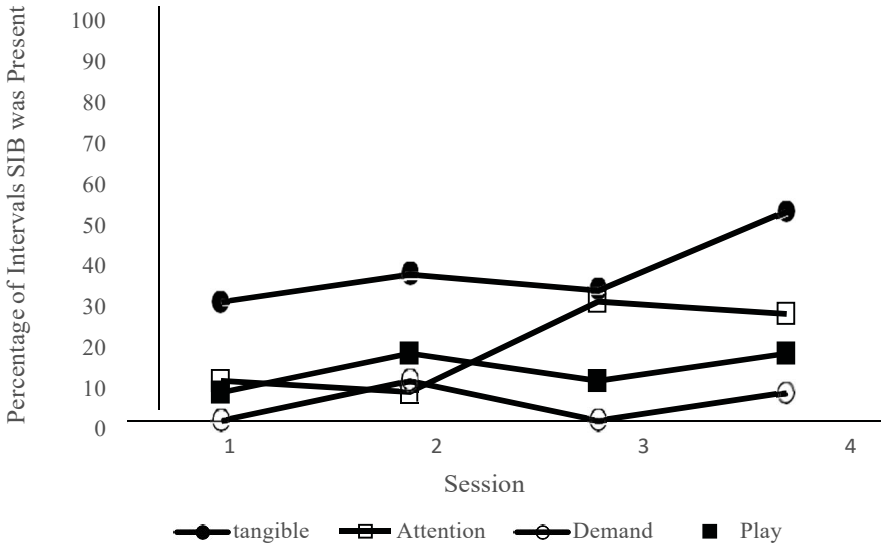

Figure A.1 Results of Aidan's Functional Analysis

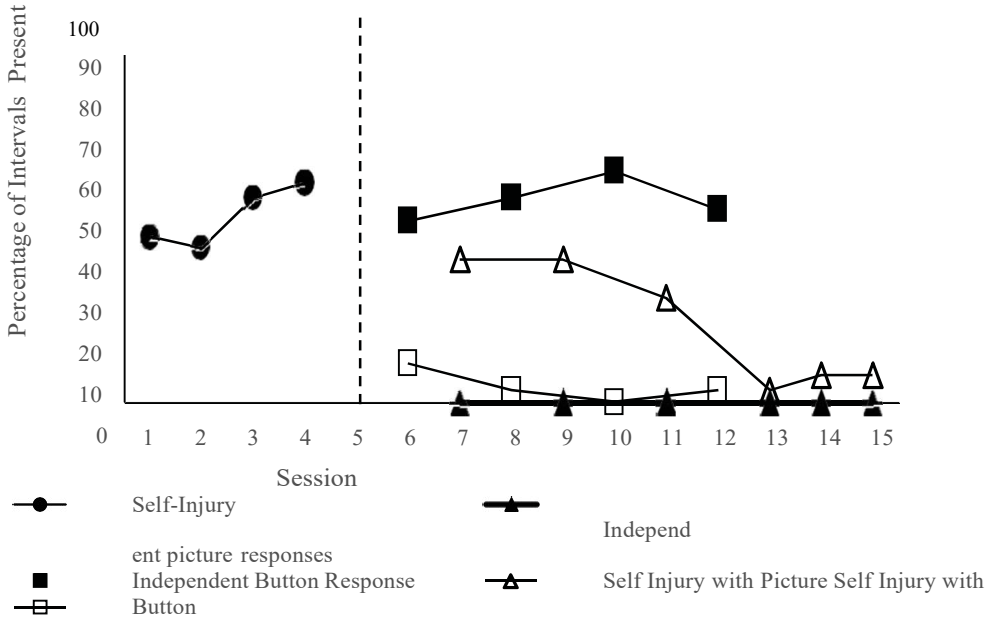

Figure A.2 Aidan's Presence of Self-Injury and Independent Communicative Responses Throughout Experiment One

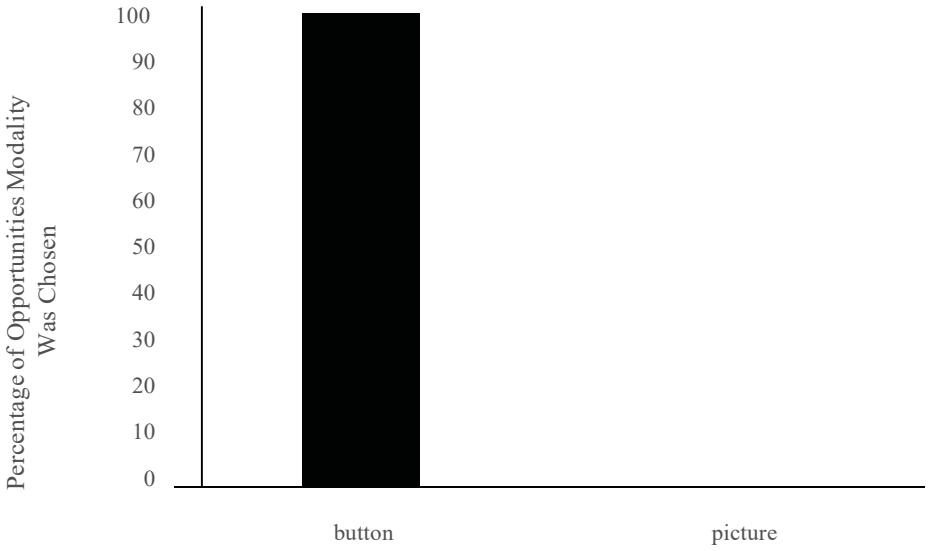

Figure A.3 Aidan's Results for Number of Times Each Modality Was Independently Used in Experiment Two

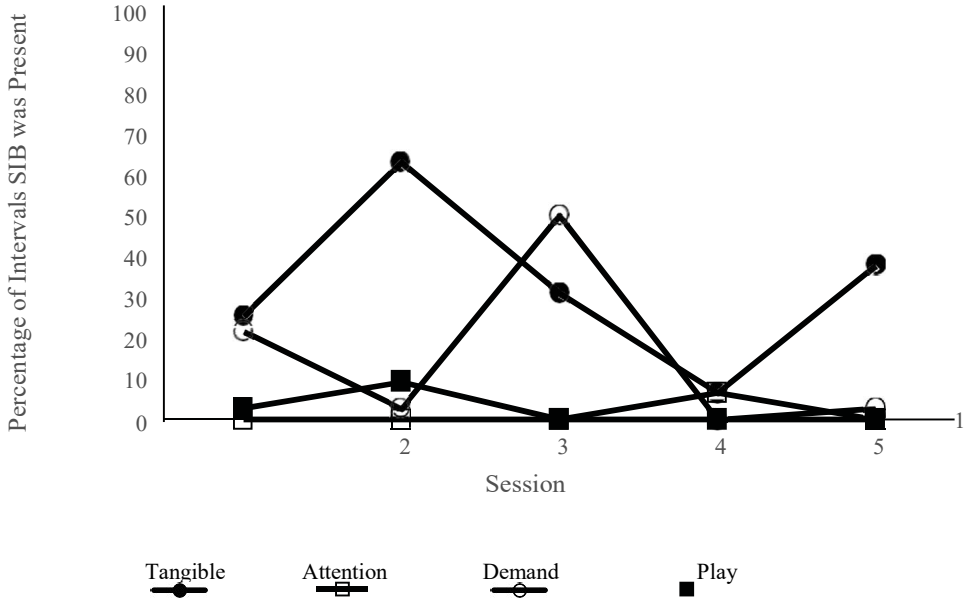

Figure A.4 Results of Brandon's Functional Analysis

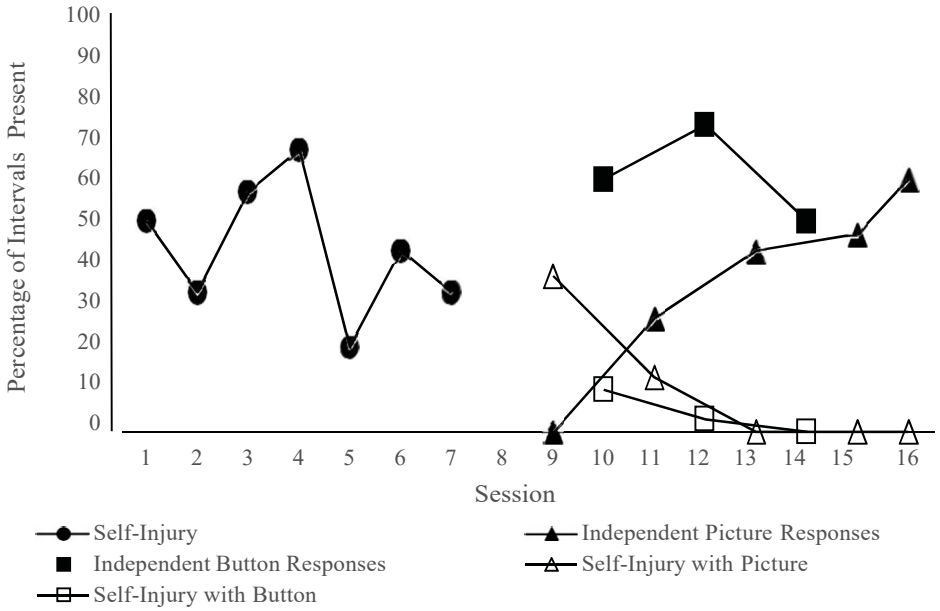

Figure A.5 Brandon's Presence of Self-Injury and Independent Communicative Responses Throughout Experiment One

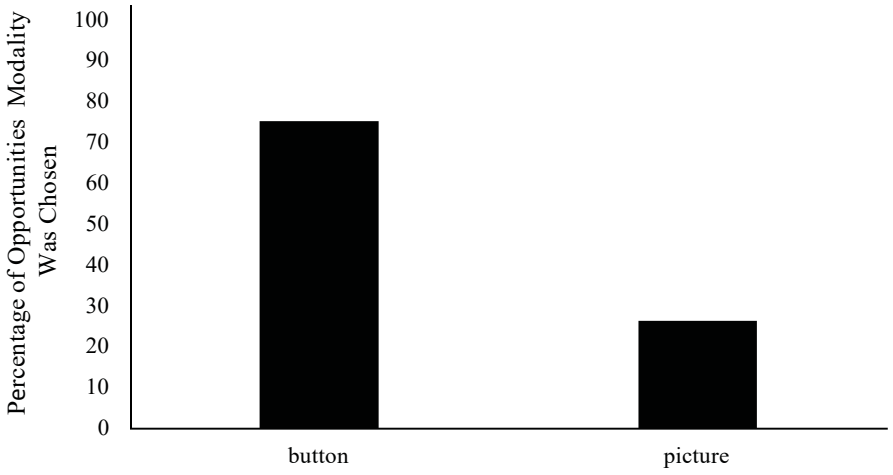

Figure A.6 Brandon's Results for Number of Times Each Modality Was Independently Used In Experiment Two

APPENDIX B

Data Sheets

Data Sheet B.1.
Experiment 1

Date:_____Time:_____ Session Number:_____Participant:_____

Primary Coder:_____

Secondary Coder:_____

Teaching Trial (circle one): picture card BIGmack

	1		2		3		4		5	
:00-:09	SIB	Mand	SIB	Mand	SIB	Mand	SIB	Mand	SIB	Mand
:10-:19	SIB	Mand	SIB	Mand	SIB	Mand	SIB	Mand	SIB	Mand
:20-:29	SIB	Mand	SIB	Mand	SIB	Mand	SIB	Mand	SIB	Mand
:30-:39	SIB	Mand	SIB	Mand	SIB	Mand	SIB	Mand	SIB	Mand
:40-:49	SIB	Mand	SIB	Mand	SIB	Mand	SIB	Mand	SIB	Mand
:50-:59	SIB	Mand	SIB	Mand	SIB	Mand	SIB	Mand	SIB	Mand

Data Sheet B.2

Experiment 2

Date:_____Time:_____ Session Number:_____Participant:_____

Primary Coder:_____

Secondary Coder:_____

Teaching Trial: Preference Assessment

	1	2	3	4	5
:00-:09	SIB	SIB	SIB	SIB	SIB
:10-:19	SIB	SIB	SIB	SIB	SIB
:20-:29	SIB	SIB	SIB	SIB	SIB
:30-:39	SIB	SIB	SIB	SIB	SIB
:40-:49	SIB	SIB	SIB	SIB	SIB
:50-:59	SIB	SIB	SIB	SIB	SIB

Experiment 2

Date:_____Time:_____ Session Number:_____Participant:_____

Primary Coder:_____

Secondary Coder:_____

	1		2		3		4		5	
:00-:09	Card	Button	Card	Button	Card	Button	Card	Button	Card	Button
:10-:19	Card	Button	Card	Button	Card	Button	Card	Button	Card	Button
:20-:29	Card	Button	Card	Button	Card	Button	Card	Button	Card	Button
:30-:39	Card	Button	Card	Button	Card	Button	Card	Button	Card	Button
:40-:49	Card	Button	Card	Button	Card	Button	Card	Button	Card	Button
:50-:59	Card	Button	Card	Button	Card	Button	Card	Button	Card	Button

Data Sheet B.3

Procedural Fidelity Checklist: Experiment One

Step	Yes	No
Therapist sets one communication device in front of participant.		
Therapist states, “Tell me what you want.”		
Therapist delivers reinforcer immediately after response is given.		
If response is not given within three seconds, therapist physically prompts response.		
Therapist allows the participant to have the reinforcer for the remainder of the fifteen-second interval after response is given.		
Therapist is alternating communication modes in teaching trials.		
Therapist looks away from participant and retains reinforcer for remainder of the interval if SIB occurs.		

Data Sheet
B.4

Procedural Fidelity Checklist: Experiment Two

Step	Yes	No
Therapist sets both communication devices in front of participant equidistant from the participant.		
Therapist states, “Tell me what you want.”		
Therapist delivers reinforcer immediately after response is given.		
If response is not given within three seconds, therapist physically removes both modes for the remainder of the fifteen-second interval.		
Therapist looks away from participant and retains reinforcer for remainder of the interval if SIB occurs.		

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