Spring 2016

Management of problem behavior maintained by negative reinforcement

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Management of Problem Behavior Maintained by Negative Reinforcement

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A thesis submitted to the Graduate Faculty of

JAMES MADISON UNIVERSITY

In

Partial Fulfillment of the Requirements

for the degree of

Master of Arts

Graduate Psychology

May 2016

FACULTY COMMITTEE:

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Acknowledgements

I would first like to thank my research advisor, Dr. Trevor Stokes, for his support throughout the last two years. His dedication to my personal successes, as well as my research, was an integral part in the completion of this study. Thank you for pushing to me think harder, and for “throwing me in” to get the most of this experience. I am so thankful for the invaluable efforts of Lexi Anderson and Becca Seymour, my two undergraduate research assistants who spent hours collecting and analyzing data. Lastly, I would like to think my parents for their continued support, love, and encouragement.

Table of Contents

List of Figures

Abstract

Literature on escape-maintained behaviors suggest a variety of treatments for children with Autism Spectrum Disorder (ASD) in the clinical and home settings. Effective interventions include, but are not limited to, functional communication training, differential reinforcement of other or alternate behaviors, noncontingent escape or reinforcement, and positive reinforcement. All utilizing behavior analytic principles, the interventions work to decrease the problem behavior being maintained by negative reinforcement. The current study examined varying schedules of noncontingent delivery of positive reinforcers in the participants' classroom to increase on-task behavior during academic demands, while decreasing disruptive escape behaviors. The conditions were introduced with one participant using a reversal (ABCBCB) design. This project contributes to the understanding of procedures used to target behaviors maintained by negative reinforcement in the special education learning environment.

Keywords: Autism Spectrum Disorder, escape behavior, noncontingent reinforcement

Introduction

Reinforcement refers simply to the increase in probability that a response will occur again in the future. This increase in responding may be due to either positive or negative reinforcement. Positive and negative here do not mean "good" and "bad," but rather the presentation or removal of a stimulus contingent upon the target response, respectively. Negative reinforcement then, by definition, is the increase in responding that is maintained by escape following the removal of an aversive stimulus (Cooper, Heron, & Heward, 2007). Miltenberger (2005) suggested that there are two classes of negative reinforcement: social and automatic. Social negative reinforcement occurs when the aversive situation is terminated by another individual (e.g., terminating a classroom assignment), while automatic negative reinforcement involves only that individual (e.g., termination of pain) (Miltenberger, 2005).

In order to obtain negative reinforcement, an individual must engage in a behavior that results in the removal of the aversive stimulus. That is, an aversive stimulus is presented and following a specific response from the individual, that stimulus is removed. It is not until that response occurs that the aversive stimulus is terminated. For this reason, those responses are often referred to as "escape" behaviors (Iwata, 1987). Any response, no matter the topography, can be an escape behavior so long as it terminates the presentation of an aversive stimulus. Due to the aversive nature of the stimulus or situation, escape responses often occur as disruptive, problem behaviors.

When an individual is presented with an aversive stimulus (e.g., academic work), access to a preferred item or activity may be terminated simultaneously. Thus, it can be tedious to decipher what is truly contributing to the problem behavior. Are the problem behaviors being maintained by the demands, or by the removal of the activity they were engaged in prior? Fritz, DeLeon, and Lazarchick (2004) investigated this question. Their study included two participants, both referred for severe destructive behaviors. Aggression, disruption, self-injurious behaviors (SIBs), and "dropping" were among the target behaviors to be examined throughout the study. Fritz et al. (2004) conducted a multiple baseline across participants design to determine the cause of the behavior.

The participants experienced three conditions: no demands, functional communication training (FCT), and no demands plus FCT. Each phase differed in the level of demand and access to the preferred activity. Fritz and colleagues (2004) showed that both participants continued to engage in high levels of destructive behavior when asked to "approach the instructional setting," even when demands were not issued. The conclusion of the study suggests that for some individuals, "destructive behaviors that occur during demand contexts may be maintained not by negative reinforcement in the form of escape from demands, but positive reinforcement in the form of access to an ongoing activity" (Fritz et al., 2004, p. 168).

Some individuals, on the other hand, engage in behaviors that are more easily identified as maintained by negative reinforcement. Once the functional analysis supports the researchers' hypothesis that the behaviors are in fact escape-maintained, the best treatment option should be considered. Among them lies the differential negative reinforcement of alternative behaviors (DNRO). In a DNRO treatment, negative reinforcement (e.g., escape) is provided when the individual does not engage in the disruptive behavior in a given interval. While this treatment option increases tolerance to aversive stimuli overtime, the most prominent limitation of this is seen in the presence of extinction bursts. When escape from a demand becomes available only upon the nonoccurrence of the problem behavior, the intensity and rate of the problem behavior may be amplified in an attempt to gain the reinforcer (Reed, Ringdahl, Wacker, Barretto, & Andelman, 2005).

Differential reinforcement of an alternative behavior (DNRA), on the other hand, provides escape from a demand situation contingent upon an alternative, desired response. This treatment option places the problem behavior on extinction, as seen in DNRO; however, DNRA may be more effective than DNRO, as it teaches an adaptive skill (e.g., task completion) to replace the problem behavior. In a DNRA treatment option, the escape contingent on the desired behavior earns the same functional reinforcer as did the problem behavior (Geiger, Carr, & LeBlanc, 2010).

Often in conjunction with the above options, is the use of noncontingent escape (NCE). During noncontingent escape (NCE) treatment, a break is given after a predetermined period of time. Unlike DNRA, negative reinforcement is delivered independent of the individual's behavior. While this option reduces the problem behavior, often immediately, it may present an accidental reinforcement of the problem behavior (Reed et al, 2005).

Kodak, Miltenberger, and Romaniuk (2003) demonstrated that two of the above treatment options could be used in conjunction to achieve a change in behavior. They employed noncontingent escape and differential reinforcement of other behaviors to decrease problem behavior during instructional time. The participants were two children, both with a diagnosis of Autism Spectrum Disorder. The researchers looked to measure disruptive behavior (e.g., pounding, grabbing, throwing) and compliance utilizing alternating treatments embedded in a multiple baseline across subjects design. During baseline, occurrence of problem behavior resulted in immediate removal of the task. In the NCE condition, a 10-second break was provided every 10 seconds. In the DNRO phase, a 10s break was given if the child did not engage in problem behaviors during that interval.

The results of Kodak et al. (2003) suggest that both NCE and DNRO produced a large decrease in disruptive behavior in both participants; however, no measure of compliance was used. Thus, a conclusive finding to determine if these treatments increase compliance as the problem behaviors decrease is not available. The researchers offer several references which suggest that compliance does in fact increase, possible for the following reasons: it was being “adventitiously reinforced”, the breaks given made the demands less aversive, praise was effective as a reinforcer after disruptive behavior decreased.

In contrast, Reed et al (2005) weighed the combinations of treatment options to determine the most effective treatment plan for increasing compliance, while reducing problem behavior. The researchers looked to demonstrate their findings in two children with developmental disabilities, both of whom displayed severe destructive behavior. Following a functional analysis that suggested the behaviors were maintained by escape, the participants entered a schedules analysis of four conditions: (1) baseline, (2) DNRA, (3) DNRA plus FTE-lean, (4) DNRA plus FTE-dense. The FTE-lean and –dense components differed in their rate of escape, either leaner or denser, respectively, to the rate of reinforcement during DNRA only. Overall, DNRA-only showed to be the most consistent in reducing problem behavior while increasing compliance.

Rather than training the individual to appropriately request a break, some treatment options employ a means of reducing the motivation for escape altogether. To do so, Mace and Belfiore (1990) utilized behavioral momentum. They suggested that preceding high-probability (high-*p*) responses with low-probability (low-*p*) responses on an academic task would establish a momentum of compliance towards the demands. To demonstrate, the researchers presented one client with severe cognitive impairment with high- and low-probability request sequences to decrease stereotypic touching. In the first phase, a demand session was implemented with Experimenter 1, during which the participant was given low-*p* requests without the presence of high-*p* request. Experimenter 2 conducted the same demand condition, though this time with the high-*p* sequence. In the second phase, the condition pairing was reversed, followed by a return to a replication of phase one in phase three. In the final phase, both experimenters conducted the high-*p* sequence.

The evidence provided in this study supported the hypothesis that “procedures aimed at increasing compliance can produce concomitant reductions in problem behavior” (Mace & Belfiore, 1990, p. 512). By presenting a low-*p* request following a sequence of high-*p* requests, the “compliance to instructions” response class was already in effect and was reinforced at a high rate. These findings are indicative of the incompatibility that occurs between compliance and disruptive behavior. In addition to their topographical differences, they assert that the two differing responses are maintained by concurrent schedules of reinforcement. Thus, “a change in the consequences for one response is likely to affect the response rate of the concurrent alternative in the opposite direction” (Mace & Belfiore, 1990, p. 512).

Several other treatments options are available to reduce escape-maintained problem behaviors. First, activity choice allows the individual to choose which demand option they would like complete. This allows the individual to, for a time, avoid the aversive task. As the tasks get sequentially completed, the individual must continue choosing from the remaining tasks. While activity choices give the individual more control, it prolongs the inevitable engagement in the aversive task. Similarly, demand fading may initially reduce problem behaviors previously maintained by escape. Demand fading involves the immediate elimination of all demands, followed by a gradual reintroduction of them. This option may be most effective for dangerous problem behaviors (e.g., SIBs) but may not be as effective for long-term reduction in disruptive behaviors (Geiger, Call, & LeBlanc, 2010).

The above treatments, utilizing negative reinforcement procedures, may be effective in decreasing problem behavior while still allowing the individual to earn the functional reinforcer (e.g. escape from demand). Though seemingly counterintuitive, positive reinforcement can also be used to effectively treat behaviors maintained by negative reinforcement. Primarily, positive reinforcement procedures can alter the motivating operations (MO) for escape. A motivating operation is an event or stimuli that momentarily alters the “reinforcing effectiveness of other events” (Michael, 1993, p.191). When a behavior is maintained by negative reinforcement, there is an establishing operation for doing so (e.g., response effort required, aversive social interaction). The presentation of demands may not only include the MO for escape, but also positive reinforcement in the form of regaining access to a preferred stimulus (Call & Mevers, 2013). With the presence of a highly preferred stimulus, the need for escape will likely be reduced, therefore, decreasing the associated problem behaviors.

Lalli, Vollmer, and Proger (1999) was thought to be one of the first studies to investigate the use of positive reinforcement to treat escape-maintained behaviors. In doing so, the researchers studied five individuals with developmental disorders who were referred for severe problem behavior. A functional analysis was conducted for each participant to isolate the function of escape as a reinforcer for his or her problem behavior. In the attention condition, toys were available but teacher attention was not. Following an occurrence of problem behavior, attention was given in the form of a disapproving comment. During the edibles phase, a preferred food item was given prior to the session then removed at the onset. The participant regained access to the edible only with the occurrence of problem behavior. Finally, in the escape condition, instruction was given every 30 seconds with a prompt. Problem behavior resulted in a brief break from the demand situation.

During intervention, baseline was followed by a positive reinforcement condition without extinction. Compliance resulted in a preferred edible item, while problem behavior earned the participant a brief break. The following condition, negative reinforcement without extinction, consisted of a break contingent upon both compliance and disruptive responses. In the third condition, compliance earned the participant a brief break; however, problem behavior no longer did. A NCE condition was then presented for one participant, wherein the participant was given a short break independent of her behavior. Finally, a fixed-ratio schedule of reinforcement was presented.

The results indicated by Lalli et al. (1999) set the stage for future research looking to investigate the treatment of negatively reinforced behaviors with positive reinforcement. The data suggest that "rates of problem behavior were lower and compliance was higher when compliance resulted in edible reinforcement… than when compliance resulted in a break..." (Lalli et al., 1999, p. 292).

Might the effects of a combination of positive and negative reinforcement procedures be more efficient in decreasing escape behaviors than either one conducted in isolation? McComas, Goddard, and Hoch (2002) investigated this possibility in a special education classroom setting. One boy diagnosed with a learning disability acted as the sole participant, whom engaged in destructive behaviors at school. Observations during a functional analysis and intervention were conducted during 10-minute sessions, using 10-second partial interval recording.

Following collection of Antecedent-Behavior-Consequence (ABC) data, a functional analysis was conducted to further determine the function of the participant's behavior. The ABC data hypothesized that the disruptive behavior was maintained by negative reinforcement, positive reinforcement, or both. To test this, three conditions were presented. In the unstructured play condition, the participant was instructed to sit at the table; however, no demands were placed upon him and he had access to preferred activities and teacher attention. No contingencies were in place for occurrence of disruptive behaviors. During the attention condition, the same instructions were given; however, he was not given access to teacher attention. Contingent upon destructive behaviors, the teacher delivered a brief period of attention, then repeated the instructions to play at the table. Finally, an escape condition was employed during which the participant was prompted to complete a series of math problems. Upon occurrence of a destructive response, a brief break was provided, followed by a prompt to return to the task. The results of this FA confirmed that the participant's behavior was being maintained by negative reinforcement (McComas et al., 2002).

Intervention began with an escape extinction condition, during which the participant was repeatedly prompted until the task was complete. He was able to postpone the demand, but not able to escape it until the worksheet was complete. Upon completion of the worksheet, another one was given, and so on until he reached a 30-minute independent seatwork time. In the second condition, escape extinction was combined with negative reinforcement. The participant was given a worksheet, and upon completion, was given a brief 5-minute break before being prompted to complete another one. This was continued until the 30-minute seatwork time was complete. Finally, during the final condition, escape extinction and negative reinforcement was combined with access to a preferred activity. The same contingencies from the second phase were in place here; however, access to a preferred activity was given during the 5-minute break.

"Preferred activities were added to the treatment package because it was hypothesized that the availability of the activity during breaks would increase the likelihood that [the participant] would complete his assignment" (McComas et al., 2002, p. 107-108). Results indicated that the participant engaged in the demand in nearly all of the intervals when preferred activities were available during breaks. The data presented by McComas et al. (2002) suggest that work breaks were not sufficient in decreasing the disruptive behaviors; however, with the addition of preferred activities during those breaks, the participant's engagement in the task increased.

For some individuals, engaging in problem behavior is their only well-developed communicative skill in their repertoire. Cipani and Spooner (1997) and Geiger, Carr, & LeBlanc (201) discuss functional communication training (FCT), a variation of DNRA, as a treatment option. In FCT, escape is provided contingent upon an appropriate communicative alternative response, or a mand. A mand, or request, "can occur under two general establishing antecedent conditions; (a) a state of deprivation…, or (b) a state of aversive stimulation" (Cipani and Spooner, 1997, p. 331). While FCT is critical in teaching functional communication skills, the high rates of mands must be immediately reinforced with escape, and thus may be disruptive to the environment. In order to be effective, the response should require less response effort and a shorter delay to reinforcement than did the problem behavior (Geiger, Carr, & LeBlanc, 2010).

FCT can be used to teach either protest skills or help responses. Protest skills are those used to appropriately request termination of an aversive task or stimulus. A help response, on the other hand, functions to decrease the difficulty of the demand via help from a teacher, therapist, or parent. For the purpose of the current paper, the focus will lie in those protest skills that present a more escape-maintained function.

Utilizing this treatment option, Hagopian, Wilson, and Wilder (2001) conducted a study to demonstrate its effectiveness in combination with noncontingent reinforcement with one participant with Autism. Like NCE, noncontingent reinforcement (NCR) is delivered independent of the individual's responding. The participant experienced two conditions following a functional analysis to provide evidence of escape-maintained behaviors. During baseline, the participant's problem behavior resulted in brief termination of the therapist's attention, as well as access to a preferred tangible. In the second condition, functional communication training, appropriate verbal requests resulted in the termination of attention and access to toys for a brief period; however, problem behaviors were placed on extinction.

In both conditions, noncontingent reinforcement was included to provide the participant with an "enriched environment" (Hagopian et al., 2001), where he had access to toys every 3 minutes independent of his behavior. The results from this study suggest that functional communication training (FCT) in conjunction with noncontingent reinforcement results in the greatest reduction in disruptive behavior. Specifically, researchers demonstrated a "96% reduction in aberrant behavior relative to baseline in both conditions" (Hagopian et al., 2001).

This alteration of the motivating operations for escape was again demonstrated by Call and Mevers (2014). A young male with a developmental disability was the single participant, whom engaged in aggression and destructive behaviors. During a functional analysis (FA) modeled after the procedures described by Iwata et al. (1982), three conditions were presented. Prior to each condition, preferred items were presented for 2 minutes until the session began. In the tangible condition, a break and access to a preferred item was only given upon the occurrence of the problem behaviors. During the attention condition, "statements of disapproval" were delivered contingent upon each occurrence of problem behavior. Finally, the toy play condition employed noncontingent access to preferred items and the therapist attention.

A demand analysis was then utilized to "program the presence and absence of MOs during demands and breaks of each condition" (Call & Mever, 2013, p. 9). Prior to treatment, functional communication training was conducted to train the participant to mand to gain access to positive reinforcers. The participant experienced both a positive reinforcement and negative reinforcement treatment. During baseline for positive reinforcement, the participant was only given access to the preferred item upon the occurrence of the problem behavior, as in the FA demand condition. As for the positive reinforcement phase, preferred items were only presented contingent on appropriate mands and not for the occurrence of problem behavior. For the negative reinforcement treatment, baseline was again the same as the FA demand condition. The intervention negative reinforcement involved a break contingent upon a mand, while problem behavior no longer resulted in escape from the task. A final condition, combining both the positive and negative reinforcement treatment phases, was employed. The participant could use either type of mand to receive either a break or a preferred item; both types of reinforcers could be obtained simultaneously with the use of their respective mands.

Call and Mevers (2014) suggested that treatments utilizing positive reinforcement result in more consistent reduction in problem behaviors previously maintained by escape. In addition, they assert that negative reinforcement procedures were relatively ineffective, unless combined with positive reinforcement contingencies. Once access to the preferred item was earned via appropriate mands, the participant did not engage in problem behavior or request a break. Thus, the hypothesis put forth by Laraway et al. (2003), as referenced in this study, is supported. It appears that the contingent presentation of a preferred item during an aversive task does in fact alter the motivating operation for escape.

In a similar study, Lomas, Fisher, and Kelley (2010) utilized differential reinforcement of alternative behaviors (DRA) to reduce the need for escape. Under the assumption that access to a preferred item makes demands less aversive, the researchers employed three boys, all of whom had been diagnosed with autism. The boys were referred to treatment of problem behaviors including aggression, destructive behavior, and self-injurious behaviors. A preference assessment to identify highly preferred items, as well as a functional analysis, was conducted prior to the onset of treatment. The functional analysis supports the researchers' hypothesis that the participants' behaviors were in fact being reinforced by escape contingencies.

During baseline, the participant was given prompts every 10 seconds until the task was completed, or the problem behavior occurred. In the presence of problem behavior, all prompting was removed for 20s; thus, the demand was no longer imminent for a brief period. The intervention phase was similar, however, positive reinforcement (e.g., edible, praise) was presented on a variable interval (VI) schedule of fifteen seconds. That is, following a 15-second interval, a preferred edible and verbal praise was delivered if the desired response (compliance) occurred.

Lomas et al. (2010) supported the findings of previous literature by displaying evidence to suggest that positive reinforcement during an aversive demand can be treated effectively for individuals who previously displayed problem behavior maintained by escape and avoidance contingencies. For the participants in this study, results indicated that preferred food items were powerful enough to decrease the motivation for escape (Lomas et al., 2010). In accordance with Call and Mevers (2014), even when escape was available, the participants engaged in little to no behavior to access it when positive reinforcement was also available. This suggests that positive reinforcement is more effective than negative reinforcement in decreasing the rates of problem behavior maintained by escape.

To further assert this effectiveness of positive reinforcement over negative reinforcement, Carter (2010) compared the two treatment procedures. Specifically, this study assessed whether “other forms of positive reinforcement (e.g., low-preference edibles and high-preference leisure items) contingent on compliance would result in reduction in problem behavior… similar to those observed by Lalli et al.” (Carter, 2010). One man with profound intellectual disability was referred for a long history of severe destructive behavior. The behaviors targeted as disruptive behaviors included slapping, pushing, hitting, and destroying items.

A functional analysis, in line with the procedures demonstrated by Iwata et al. (1982) and several of the above studies, was conducted to determine the function of the target behaviors. Results of the FA determined that the participant’s behavior was maintained by escape from self-care demands. In addition, a paired-choice preference assessment was conducted for food and leisure items. The experimental design began with a baseline condition, during which the participant was prompted to complete a task and earned verbal praise upon compliance, and a brief break upon the occurrence of disruptive behavior.

In the first intervention phase, high-preference edible items were delivered upon completion of the task, and destructive behavior resulted in a 30 second break. In the escape condition, both compliance and destructive behavior resulted in brief break. In the third treatment condition, a high-preference leisure item, rather than a preferred edible, was delivered upon compliance with the demand. Destructive behavior still resulted in a brief period of escape from the task. Finally, similar to the first treatment condition, a preferred edible item was presented contingent upon compliance and a break delivered following the occurrence of destructive behavior. However, in this final phase, the reinforcer was a low-preferred edible.

The results displayed by Carter (2010) asserted that the presentation of a high-preference item contingent upon compliance of a task decreased problem behaviors, even if those behaviors resulted in a break from the demand. Additional findings, comparing high- and low-preference items, suggested that low-preference edibles or leisure items are highly ineffective in reducing destructive behaviors. In fact, their presentation contingent upon compliance resulted in a decrease in compliance and heightened level of problem behaviors (Carter, 2010). Overall, the data supported the findings previously discussed by Lalli et al. (1999) demonstrating that high-preference items are more effective in decreasing disruptive behavior, even when escape contingencies are present.

The compilation of the studies using either negative reinforcement, positive reinforcement, or both, allows future research to continue investigating which may be most effective in reducing escape-maintained disruptive behaviors. While many of the above investigations were conducted in a hospital or clinical setting, a wealth of these escape behaviors occur in the instructional setting. Negative reinforcement procedures, though often used, may not be practical in a classroom. Appropriate means of requesting a break from instructional demands may be seen as a useful skill; however, repeated reinforcement involving these breaks may prove to be disruptive to the teachers, other students, and class schedule. As an alternative, positive reinforcement procedures may be employed to obtain a greater reduction in disruptive escape-maintained behaviors. The use of positive reinforcement, in the form of tangibles or positive social consequences, appears to be a more practical option for the classroom.

Specifically, delivering positive reinforcers independent of the individual's behavior may be effective in reducing the likelihood of extinction bursts following the termination of reinforcement for escape behaviors. Using baseline levels of the target behaviors, the appropriate schedule of noncontingent positive reinforcement may be determined. As in Reed et al (2005), varying schedules of delivery may result in differing rates of behavior. Depending on the individual, setting, and treatment provider, dense or lean schedules of noncontingent reinforcement may be preferred over the other. Hagopian et al (2001) focused on the culmination of effects of noncontingent positive reinforcement and FCT. In isolation, how effective might noncontingent positive reinforcement be in reducing escape-maintained behaviors?

While the escape behaviors treated are exhibited by many individuals across a variety of contexts, they are particularly prevalent in special populations. Children with Autism Spectrum Disorder (ASD), specifically, may display high rates of problem behavior maintained by negative reinforcement. These behaviors may occur at increasingly high rates in the classroom setting, as more demands are placed on them. The heightened aversion to academic tasks could be due to a variety of triggers.

First, Rutter and Lockyer (1967) suggest that "as many as 75 percent of individuals with autism have a learning disability, and that half functioned in the severe range (O'Brien & Pearson, 2004, p.127). Severe learning disabilities are defined by O'Brien and Pearson (2004) as having an IQ less than 50. Thus, learning presents challenges to children with Autism Spectrum Disorder in the classroom as tasks may simply be more difficult. Because IQ is highly correlated with language, not only will the task itself be difficult, but understanding the task instructions may be challenging as well (O'Brien & Pearson, 2004).

Difficulties in transitioning may pose a second challenge to children with ASD in a learning environment. Transitions occur when the child moves from one activity to another. The unpredictability that accompanies these transitions can cause confusion and anxiety in a child with ASD (Stoner, Angell, House, & Bock, 2007). Though the heightened unease caused by a transition may not be a direct effect of the new task, the summation of anxiety with the new demand will likely increase the aversiveness of the task. Seemingly, as the transition prior to an academic task becomes more difficult, the overall rates of escape-maintained problem behaviors may escalate.

Finally, the social interactions involved in the learning environment might be yet another factor contributing to the high rates of escape behavior exhibited by children with ASD. Children diagnosed with ASD are said to have marked abnormal social development characterized by a lack of responsiveness to others (Mundy, Sigman, Ungerer, Sherman, 1986). Children with ASD are presented with social interactions in the learning environment with their teachers, peers, or both. This inevitable social interaction that accompanies the presentation of an academic task adds another tier of aversion, making escape more valuable.

The purpose of the current study is to employ a noncontingent schedule of delivery of positive reinforcers to target negatively reinforced behaviors in children with Autism Spectrum Disorder that can be utilized efficiently in the special education classroom environment. We expect the participant to present lower rates of disruptive behaviors maintained by escape, while increasing the rate of compliance during academic demands.

Method

Participants

Participants in this study was a student in a self-contained Autism classroom. Researchers recruited him based on previous practicum experience in the classroom, as well as referral from the lead teacher. Nicholas was a 6-year-old male, diagnosed with Autism Spectrum Disorder (ASD). He was at a first grade level in the classroom, and spends 2 hours per day in a general education setting. Nicholas had a well-developed verbal repertoire, and received Speech-Language Pathology services through the public school. (Child name is a pseudonym.)

The participant and his legal guardian provided informed consent prior to his participation in this research. Written consent was consistent with the James Madison University Institutional Review Board approved protocol. A copy of the consent form is provided in Appendix A.

Setting

This study was conducted in the participant's elementary school. Observers coded behavior during a structured academic activity in the self-contained classroom at the school. The class actively incorporates the Competent Learner Model curriculum, a program designed to implement sustainable goals for learners with special needs (Tucci, Hursh, Laitinen, & Lambe, 2005). The classroom was approximately 8.1 meters long and 5.6 meters wide. In the classroom, there was a free-play area with toys, two cubbies for the students' belongings, three large desks, a time-out area, a SMARTboard and two computers. Toys in the classroom included, but were not limited to, Legos, Play-Doh, a pretend kitchen, cars, and "independent bins." One head teacher and three teaching assistants were present during this study. Observers coded during the regular school day between the hours of 11:00a, and 11:45am; thus, 8 other children were in the classroom.

Behaviors Observed

Four behaviors were included in the class of disruptive behaviors. *Walking away* was defined as the participant leaving the table (one or more meters away) and task before being excused by the instructor. *Dropping* was defined as moving from a standing or sitting position (in chair) to a position on the floor, or resting head face-down on the table, in the absence of instruction to do so from the teacher. *Disruption* was defined as pushing objects involved in the academic task from the table, hitting other students and/or teachers, and speaking at a volume louder than a normal conversational level for the classroom. Finally, *complaint of illness* was scored as a reoccurring complaint of an ailment following notification from school nurse that no illness is present, or reoccurring requests to use the bathroom following a restroom break immediately prior to the observation. *On-Task Behavior* was defined as the participant sitting at the table, using the materials appropriately for that activity, with head and eyes oriented towards the teacher and/or task for at least 10 cumulative seconds of the 15-second interval.

Data Collection

Two undergraduate psychology students coded observations. The observers were trained by coding practice sessions for 1 week prior to the study. The observers coded live sessions during the study in the classroom. Data measuring disruptive behavior was collected during 10-minute observations, utilizing partial-interval recording of 15-second intervals. Compliance was measured for 10 minutes using partial-interval recording of 15-second intervals.

Interobserver agreement (IOA) was scored for 32.5% of the sessions in each condition, including baseline. IOA for disruptive behaviors and compliance was conducted using the interval-by-interval method. The primary investigator acted as the independent reliability observer who collected data in the exact way as the undergraduate researchers. The IOA calculated represents the rate of agreement per observation. This was measured by dividing the total number of intervals by the number of intervals agreed upon by each observer, multiplied by 100.

Procedures and Experimental Design

A reversal design (ABCBCB) was used in this study (Johnston & Pennypacker, 2009). A functional analysis and a preference assessment were done prior to the onset of the study to confirm the function of the behavior, as well as identify the most powerful reinforcers for the participant. Experimental conditions (B and C) were implemented alternately following a stable baseline. Data for both the desired and undesired behaviors were measured concurrently and analyzed using visual analysis. The graphic analysis examines participant's behavior before and after interventions for each target behavior. The trend, level, and variability in the data can be seen in the graphic analysis (Johnston & Pennypacker, 2009).

Preference Assessment. A paired-choice stimulus preference assessment was conducted for (a) edibles, (b) tangibles, and (c) social reinforcers. High-preference items were those selected on at least 80% of all trials, while all other items below 80% were considered low-preference. High-preference edible items included M&Ms and Doritos.

High-preference tangible items included a toy windmill and an electronic tablet. None of the social reinforcers presented proved to be high-preference items, as all fell below 80% selection.

Functional Analysis. A functional analysis using the procedures described by Iwata, Dorsey, Slifer, Bauman, and Richman (1994) and Hanley, Jin, Vanselow, and Hanratty (2014) was conducted. Demand, social attention, alone, and play (control) conditions were employed. In the demand condition, a Licensed Behavior Analyst (LBA) presented an academic demand to the participant. Contingent upon the occurrence of problem behavior, the task was removed from the student and the LBA turned away for 30 seconds, before re-presenting the task. During the social attention condition, the participant was instructed to play with toys, and was told "I'm here if you need me", as the LBA sat across the room and pretended to work. The LBA provided brief attention contingent upon the occurrence of the problem behavior. During the alone condition, the participant was observed alone, in the absence of leisure items and interactions with other individuals. The play condition was used as a control, during which the LBA and participant interacted in a playful manner using classroom toys. No demands were placed on the client, and attention was provided every 30 seconds regarding the play activity. All target behaviors were ignored during this control condition.

Though none of the target behaviors were self-injurious in nature, a termination criterion was set to discontinue the session contingent upon the occurrence of 5 instance of self-injury. Consistently high frequencies of problem behavior during the demand condition suggest escape as the primary function for the participant's engagement in problem behavior.

Baseline. The teacher and assistants in the classroom were instructed to carry out the structured activity as they typically would. Their sessions occurred in a self-contained Autism classroom at an elementary school in Virginia. Researchers gave no feedback following each observation.

Intervention. Prior to intervention, the lead teacher was trained and consulted regarding the implementation of the intervention. The lead teacher was primarily responsible for implementing the intervention. During the activity, all materials were set out prior to calling the student over. Observation began one minute after the teacher called for the student to come to the activity. Once there, the student was given an academic task to complete. During the 15-second interval condition (B), the student was given a social reinforcer (e.g., high-five, squeeze, tickle) every 15-seconds, independent of his on-task behavior. In conjunction, a highly preferred edible was delivered every fourth interval (every minute on the minute), independent of on-task behavior. The same ratio of reinforcers (social and edible, 3:1) were delivered in the 30-second interval condition (C); however, the delivery was thinner resulting in an edible once every 2 minutes.

Results

The results of the the participant's performance during each of the conditions is represented in Figures 1, 2, and 3. Figure 1 shows the percentage of intervals for each 10-minute observation during which the participant engaged in on-task behavior. Nicholas increased his average on-task behavior from 30.3% during baseline to an average of 55.2% across the three replications of the first intervention condition (B), a 15-second delivery of noncontingent reinforcement. The third condition (C), a 30-second delivery of

NCR, resulted in little to no change from baseline rates, as the average remained at 30.9%. This C condition was replicated twice.

Figure 2 displays the percentage of intervals of each 10-minute observation during which Nicholas engaged in escape-maintained problem behaviors. During baseline, Nicholas engaged in escape-maintained behaviors an average of 27.9% of the 10-minute session. During the B and C conditions, his average rates of escape behaviors were reduced to 6.8% and 11.6%, respectively. Figure 3 illustrates the distribution of rates of each of the four target escape behaviors. While all problem behaviors showed a decrease during the intervention phases of the study, disruptive behaviors (e.g., hitting, swiping) resulted in the most dramatic reduction, from an average of 12.9% during baseline to an average of 3.7% across the remainder of the sessions.

Treatment fidelity checklists were used to monitor the teacher's implementation of noncontingent reinforcement delivery. Checklists were completed by the primary researcher three times per each condition and replication. No additional trainings for the teacher were necessary, as determined by high performance and accuracy on the treatment fidelity checklist. Based on the treatment fidelity checklist, the procedures implemented remained in accordance to those proposed. The treatment implemented by the teacher was conducted twice daily three days per week.

A social validity questionnaire was given to the teacher at the conclusion of the research. The teacher was to rate the appropriateness, importance, and implementation using a Likert scale of 1-5, where 5 represented agree, 4 represented somewhat agree, 3 was neutral, 2 represented somewhat agree, and 1 represented disagree. The social validity questionnaire has not yet been returned, as the teacher left for maternity leave following the last day of data collection.

Discussion

The present study demonstrated a noncontingent reinforcement procedure to decrease escape-maintained behavior while increasing on-task behavior in a child with autism in a special education setting. Previous literature demonstrated the effectiveness of noncontingent reinforcement in conjunction with other treatments, although little research has focused on the isolated effects of noncontingent reinforcement. Little research has been done to show the effects of positive reinforcement on behaviors maintained by negative reinforcement. More specifically, the current study focused on demonstrating the effects of varying schedules of noncontingent reinforcement on the target behaviors.

Figure 1 illustrates the percentage of intervals during which the participant engaged in on-task behavior, during each 10-minute observation. Nicholas displayed the highest rates of on-task behavior during the 15-second interval condition. That is, when noncontingent reinforcement was delivered more often, Nicholas spent a larger percentage of the 10-minute session on-task, as compared to the 10-second interval condition. As expected, on-task behavior was low during baseline; however, data from the 15-second interval condition illustrated similar rates of on-task behavior. For Nicholas, the data suggested that noncontingent delivery of preferred items must occur somewhere between every 15 and 30 seconds in order to reap the greatest improvements in on-task behavior and decrease in problem behavior during a nonpreferred academic task.

Figure 2 depicts the percentage of intervals during which the participant engaged in escape-maintained behaviors. Following baseline, escape-maintained behaviors remained low throughout the 10-second and 15-second interval conditions. Presumably, the delivery of preferred items was effective in decreasing rates of the target escape behaviors, regardless of which of the two schedules was in place. To expand, future studies could investigate the effects of a wider range of schedules to increase the sensitivity to varying rates of escape behaviors. Figure 3 illustrates the break-down of each escape behavior throughout the study, as the conditions changed. At the onset of the study, researchers hypothesized that there may be reductions in some target behaviors but not others. The data in Figure 3 suggest that all four of the target problem behaviors followed the same trend and level following baseline.

Collectively, the data suggested that delivery of a preferred item every 15 seconds was most effective in increasing on-task behavior, and decreasing escape behaviors, in this single participant. While the 30-second interval condition was effective in maintaining low rates of escape behaviors, it did not result in greater-than-baseline rates of on-task behavior. Why was on-task behavior more sensitive to the changes in reinforcer delivery than were the problem behaviors? Researchers of the current study hypothesized that on-task behavior and problem behaviors would go hand-in-hand; that is, as on-task behavior increases, problem behavior would increase and vice versa. However, the data determined that may not necessarily be true.

Potentially, learning may have occurred during the first intervention phase (15 seconds), independent of the schedule of reinforcers. Nicholas may have determined that a reduction in problem, escape-maintained behaviors results in a social or edible reinforcer, and thus, maintained those low levels throughout. Perhaps the results would be very different had the first intervention phase been the 30 second condition. A second possible explanation for this result lies in the concept of behavior momentum. Prior to the study, the stimuli surrounding on-task and problem behaviors were differentially reinforced. That is, the triggers for one behavior were more densely reinforced than the other. This differential reinforcement may have then persisted into the study due to behavior momentum surrounding problem behavior.

The reversal design, repeating the two intervention conditions, allowed the researchers to gain experimental control. The data demonstrated control over several variables. First, observations were conducted during two different activities each day: mathematics and small-group reading. The high number of observations, and repetition of each condition, controlled for the possibility that the two activities would yield different outcomes. Additionally, there was no time-dependent increase or decrease in on-task behavior and problem behaviors respectively. The tasks during each activity were changed throughout the study, allowing the data to suggest that the level of difficulty of the task remained roughly the same. Had on-task behavior continued to improve, or problem behavior decrease, across the entirety of the study, one might suggest a mastery of the material.

While the results indicate a clear increase in on-task behavior and a decrease in target escape behaviors during the 15-second interval condition, for this single participant, the present study sets forth several limitations. First, the changes in task for the two different activities eliminating the opportunity to use permanent product as a measure of the target behaviors. While the method for observation was clearly defined, a permanent product measure may have been shown to increase the reliability of the data. Permanent product measures may have been used if the observations occurred during just one activity, and used a product that would remain constant across the session (e.g., number of place value charts completed).

Second, the participant underwent medication changes at several points throughout the study. According to teacher and parent report, the student was placed on a sleep medication. The teacher reported an increase in “outbursts” and crying throughout the school day for approximately 1.5 weeks. Additionally, the participant’s mother reported that the participant recently had a dosage change on one of his medications. She reported that this may cause him to be “in a fog” at various times throughout the day, per her observations at home. These medication changes may have altered the participant’s performance during academic tasks, whilst observations were being conducted. After closer analysis of the sessions during which medication changes may have been a factor, the primary researcher has concluded that the changes were distributed evenly throughout the study. Thus, we can conclude that medication changes were not affecting one condition of the intervention more than another.

Next, several observations occurred during which the teacher was one-on-one with the participant. While the noncontingent delivery of reinforcers was unaffected, the teacher was able to give her undivided attention to the participant, perhaps functioning as an additional reinforcer. One-on-one instruction, when it was observed, only occurred during mathematics due to other students’ absences. In addition, on several occasions, the activity concluded prior to the observation period ending. When this occurred, the teacher gave the participant tasks unrelated to the mathematics or small-group reading activity.

The data do not suggest an affect on the participant's behavior, though this was a slight deviation from the treatment protocol.

Lastly, and perhaps most pertinent, is the likelihood that delivery of reinforcers may sometimes be accidentally contingent. While the schedule of delivery was *independent* of the participant's behavior, the delivery could have immediately followed the occurrence of a desired behavior. For example, the participant may have completed a place-value chart as the 15-second interval was ending, resulting in delivery of a reinforcer. This accidental contingent delivery of reinforcers may have become *dependent* on the participant's behavior, therefore impacting the results.

The current study provides a variety of possibilities for the direction of future research related to the noncontingent delivery of positive reinforcers. While the present data suggested a clear result for this participant, replication of the procedures for more participants may provide a better illustration of the use of noncontingent reinforcement to target escape behaviors for children with autism. In addition, data should be collected on the teacher's behavior as well as the students' behavior. By measuring the teacher's behavior during baseline, researchers can determine the magnitude of contrast between baseline and the schedules of delivery during intervention.

Another direction that future research could take to expand on the current findings is a smaller change in interval for delivery of noncontingent reinforcers. In the present study, the difference in conditions was 30 seconds. Perhaps smaller increments in intervals would show a more specific threshold for which noncontingent reinforcement is no longer effective for each participant. With that in mind, a wider range of intervals may be necessary to account for each participant in a multiple baseline design.

The generalization of targeting escape behaviors may prove to be an interesting direction for future studies, as well. Would the increase in on-task behavior and reduction of escape behaviors be maintained across settings (e.g., at home)? With other people (e.g., parents)? With other behaviors (e.g., chores)? Stokes and Baer (1977) referred to this generalization as Train and Hope. The most frequent method, Train and Hope, occurs when behavior change occurs "across responses, settings, experimenters, and time, is concurrently and/or subsequently documented or noted, but not actively pursued (Stokes & Baer, 1977, p. 351.

Generalization research specifically designed to investigate escape-maintained behaviors may suggest interesting findings related to the use of noncontingent reinforcement. Following conclusion of the current study, additional observations will be conducted to assess the Nicholas's performance with the long-term substitute that is replacing the teacher for the remainder of the year. Observations will allow the primary investigator to determine if generalization, without programming, has been achieved.

The current investigation adds to the limited literature on noncontingent positive reinforcement, as well as that of the use of positive reinforcement contingencies to target behaviors maintained by negative reinforcement. Primarily in a self-contained autism classroom, this research shows that noncontingent delivery of preferred items (e.g., social, edible) every 15 seconds can be used by teachers to effectively increase on-task behavior decrease escape-maintained problem behaviors during academic tasks.

Figure 1.

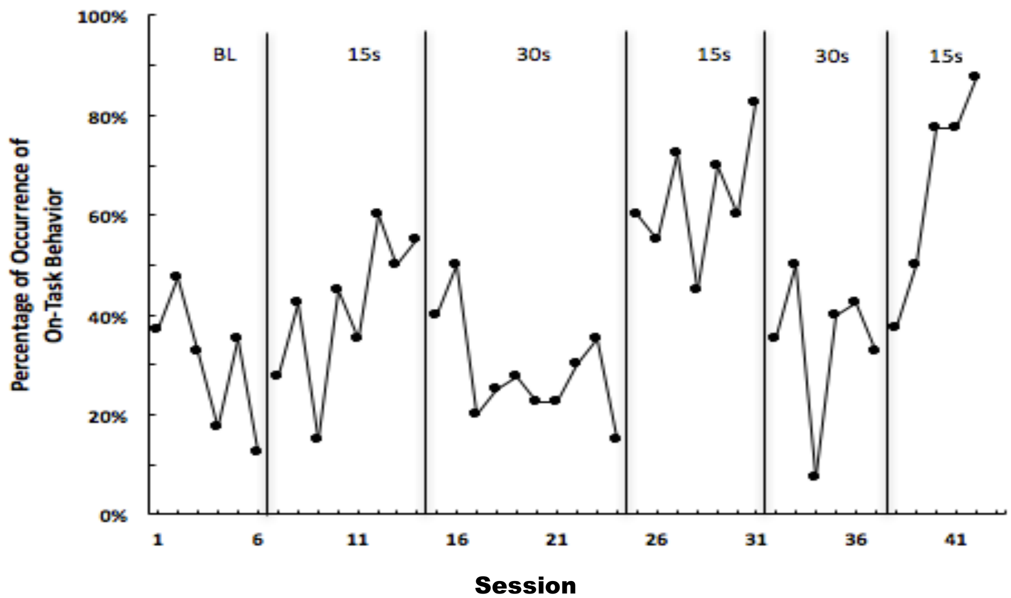


Figure 1 represents percentage of intervals of occurrence of on-task behavior during each 10-minute observation for Nicholas.

Figure 2.

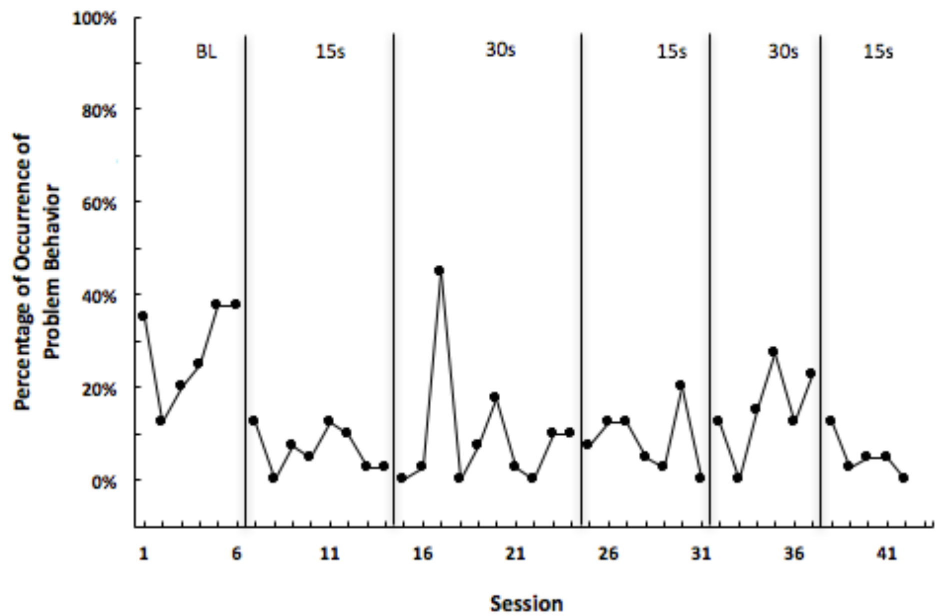
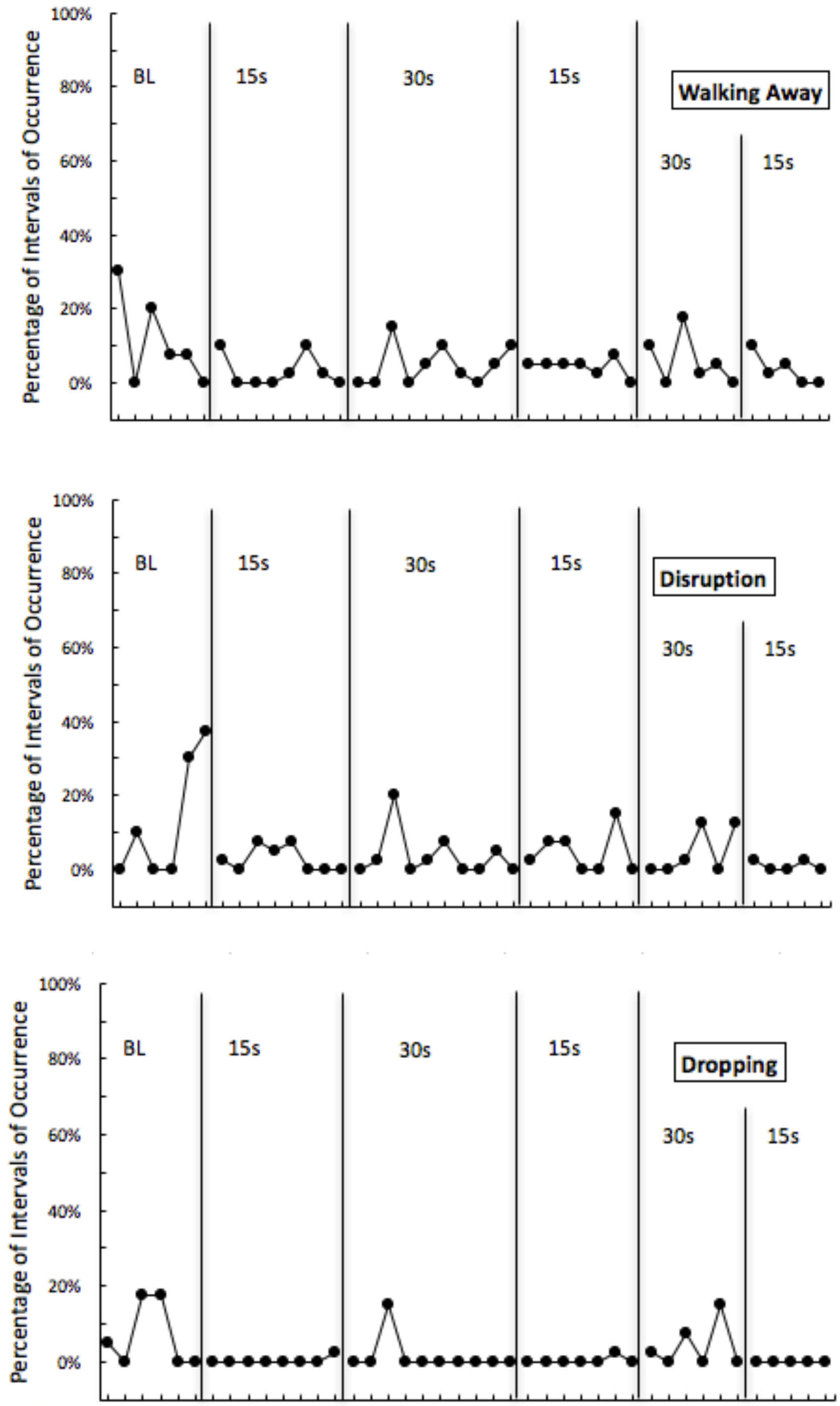


Figure 2 represents the percentage of intervals of occurrence of problem behaviors in total for Nicholas.

Figure 3.


Percentage of Intervals of Occurrence
100%
80%
60%
40%
20%
0%
BL
15s
30s
15s
30s
15s
Walking Away
Percentage of Intervals of Occurrence
100%
80%
60%
40%
20%
0%
BL
15s
30s
15s
30s
15s
Disruption
Percentage of Intervals of Occurrence
100%
80%
60%
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0%
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15s
Dropping

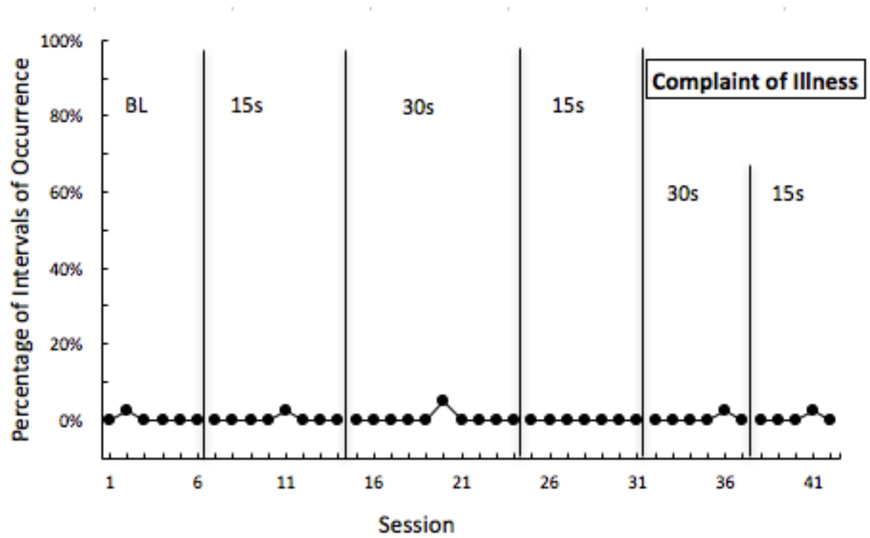

Figure 3 represents the distribution of each of the four target problem behaviors for Nicholas.

Appendix A: Consent Form

Parent/Guardian Informed Consent

Identification of Investigators & Purpose of Study

Your child is being asked to participate in a research study conducted by Anna Cruise and Dr. Trevor Stokes from James Madison University. The purpose of this study is to decrease behaviors currently maintained by escape and avoidance, in order to increase on-task behavior during academic tasks. This study will contribute to the researcher's completion of her Master's thesis for partial completion of a Master's degree in Psychological Sciences, with a concentration in Behavior Analysis.

Research Procedures

Should you decide to allow your child to participate in this research study, you will be asked to sign this consent form once all your questions have been answered to your satisfaction. This study consists of a positive reinforcement procedure that will be administered to individual participants in Mrs. Christina Miller's classroom. Your child will not be asked to engage in any activities in addition to their regularly scheduled academic day.

Time Required

Participation in this study will require zero additional hours of your child's time spent at Stone Spring. The study will be conducted during the current schedule implemented in the classroom.

Risks

The investigators do not perceive more than minimal risks from your child's involvement in this study (that is, no risks beyond the risks associated with everyday life).

Benefits

Potential benefits from participation in this study include: decreased disruptive behaviors currently being maintained by escape and/or avoidance of a task, and increased engagement during academic tasks. Benefits of this study to the field of applied behavior analysis will primarily be the expansion of such interventions into the special education classroom setting.

Confidentiality

Your child will be identified in the research records by a pseudonym or number. The researchers retain the right to use and publish non-identifiable data. When the results of this research are published or discussed in conferences, no information will be included that would reveal your child's identity. All data will be stored in a secure location accessible only to the researchers.

There is one exception to confidentiality we need to make you aware of. In certain research studies, it is our ethical responsibility to report situations of child abuse, child neglect, or any life-threatening situation to appropriate authorities. However, we are not *seeking this type of information in our study nor will you be asked questions about these issues.*

Participation & Withdrawal

Your child's participation is entirely voluntary. He/she is free to choose not to participate. Should you and your child choose to participate, he/she can withdraw at any time without consequences of any kind.

Questions about the Study

If you have questions or concerns during the time of your child's participation in this study, or after its completion or you would like to receive a copy of the final aggregate results of this study, please contact:

Anna Cruise
Psychological Sciences
James Madison University
cruiseal@dukes.jmu.edu

Dr. Trevor Stokes, Ph.D.
Graduate Psychology
James Madison University
Telephone: (540)-568-5067
stokestf@jmu.edu

Questions about Your Rights as a Research Subject

Dr. David Cockley
Chair, Institutional Review Board
James Madison University
(540) 568-2834
cocklede@jmu.edu

Giving of Consent

I have read this consent form and I understand what is being requested of my child as a participant in this study. I freely consent for my child to participate. I have been given satisfactory answers to my questions. The investigator provided me with a copy of this form. I certify that I am at least 18 years of age.

____
Name of Child (Printed)

____
Name of Parent/Guardian (Printed)

____________________________________ _____________
Name of Parent/Guardian (Signed) Date

____________________________________ _____________
Name of Researcher (Signed) Date

Appendix B: Data Sheet

Observer ID:
Date:

IOA? Y / N
% IOA:

15s 30s 45s

% On-Task

1				2				3				4				5				6				7				8				9				10			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

% of Occurrence: _____ / 40= _____%

% Disruptive Behaviors

1								2								3								4								5							
1		2		3		4		1		2		3		4		1		2		3		4		1		2		3		4		1		2		3		4	
Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI
W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di
6								7								8								9								10							
1		2		3		4		1		2		3		4		1		2		3		4		1		2		3		4		1		2		3		4	
Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI	Dr	CI
W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di	W	Di

% of Occurrence: _____ / 40= _____%

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