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THE EFFECTS OF TEACHER IMPLEMENTATION OF DIFFERENTIAL REINFORCEMENT OF ALTERNATIVE BEHAVIOR IN INDIVIDUALS WITH AUTISM SPECTRUM DISORDER

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THE EFFECTS OF TEACHER IMPLEMENTATION OF DIFFERENTIAL
REINFORCEMENT OF ALTERNATIVE BEHAVIOR IN INDIVIDUALS WITH
AUTISM SPECTRUM DISORDER

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in the
College of Education
at the University of Kentucky

By

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ABSTRACT OF THESIS

THE EFFECTS OF TEACHER IMPLEMENTATION OF DIFFERENTIAL REINFORCEMENT OF ALTERNATIVE BEHAVIOR IN INDIVIDUALS WITH AUTISM SPECTRUM DISORDER

The purpose of this study was to evaluate the effects of a classroom teacher implementing trail-based functional analyses (FAs), experimentally evaluate the effects of a classroom teacher implementing differential reinforcement of alternative (DRA) procedures with participants diagnosed with autism spectrum disorder in the context of a natural setting, and assess the feasibility of the DRA for the classroom teacher. A multiple baseline with an embedded ABAB design was used for one participant and an ABAB design was used for the second participant to measure the percentage of the participants' engagement in the alternative behavior and the target behavior. Results showed that the classroom teacher could implement the trail-based FAs with fidelity, DRA procedures were effective for both participants, and the teacher was neutral in regard to the feasibility of the procedures.

KEYWORDS: Differential reinforcement of alternative behaviors, classroom, autism, trial-based functional analysis, teacher training

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April 12, 2019

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Section 1: Introduction

Aberrant behaviors displayed in classroom settings can have adverse effects on social engagement, academic engagement, and subsequently, academic achievement for students (Boyle et al., 2011). It has been estimated that between 48% to 82% of students diagnosed with developmental disabilities may display aberrant behaviors that do not respond to routine classroom procedures and behavior management strategies (Dart, Radley, Mason, & Allen, 2018). In these cases, it is imperative to identify an intervention that targets the function that is maintaining the aberrant behavior. School personnel typically conduct a functional behavior assessment (FBA) in an attempt to identify behavioral functioning for problematic behaviors that are non-responsive to less intrusive interventions (Dart et al., 2018) and, in some cases, the FBA is required by law (e.g., manifestation determination) (IDEA, 2004). Determining behavioral functioning aids in better understanding the challenging behavior and developing interventions.

All behaviors, both appropriate and inappropriate, are maintained by one or more of the following functions: a) socially mediated positive reinforcement (e.g., access to attention); b) socially mediated negative reinforcement (e.g., escape from a task demand); c) non-socially mediated positive reinforcement (e.g., stimulation from hand flapping); or d) non-socially mediated negative reinforcement (e.g., scratching an itch) (Cooper, Heron, & Heward, 2007). Behavioral functioning has been identified for a variety of aberrant behaviors including, but not limited to, behaviors such as self-injury, aggression, off-task, stereotypy, property destruction, food refusal, pica, and psychotic speech (Ervin, Radford, Bertsch, & Piper, 2001). Several assessments can be conducted to inform a FBA. These assessments can be broken down into two categories, indirect and direct.

Indirect assessments include, but are not limited to, interviews, questionnaires, and rating scales. Direct assessments that can be used to inform a FBA include direct observation considering the antecedent, behavior, and consequences following the behavior of concern as well as functional analyses (FAs) (Lloyd, Weaver, & Staubitz, 2015). The standard FA as described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994) is used to determine the function of aberrant behaviors by manipulating antecedent and consequent events surrounding the target behavior. During a standard FA, rates of challenging behavior during specific test conditions including attention, tangible, escape, alone, and ignore conditions are assessed to determine the maintaining function. Each of these conditions last fifteen min and the series of tests conditions are replicated until a function is determined. This assessment is considered the gold standard in determining the function of aberrant behaviors (Hanley, 2012), however, it is rare for a FA to be conducted in a classroom as a part of the FBA process. There are a number of factors that contribute to this. Some myths about conducting FAs include the following: a) FAs are believed to be too complex (Durand & Crimmins, 1988), b) FAs are too time consuming (Axelrod, 1987), and training caregivers or teachers to implement FA procedures accurately would be unrealistic (Paisey, Whitney, & Hislop, 1990). Paisey et al. (1990) also suggested conducting a FA would take too much time, cost too much money, and the results of an FA would increase the probability of the use of more aversive treatments. Although these were valid concerns, many have been addressed in the literature. Northup et al. (1994) systematically trained school personnel to conduct FAs in a classroom setting. They reported that the FAs were not time consuming and resulted in the development of an individualized, effective treatment that maintained approximately 18

months for four of the five participants (Northup et al., 1994). The authors also noted that functions determined by the FAs did not match functions hypothesized during the FBA process.

Watson, Ray, Turner, and Logan (1999) trained a teacher to conduct a FA in a self-contained classroom for a student that displayed high rates of SIB. The results of direct observations and a FBA were inconclusive, so the researchers trained the teacher through the FA process. First, the researchers provided instruction on the FA process by explaining the procedures. Following instruction, researchers modeled the procedures with the student while another researcher simultaneously described the features of the FA. Following the modeling procedures, the teacher practiced the FA procedures with corrective feedback from the researchers until she demonstrated all of the steps with a minimum of 90% accuracy. Procedural fidelity was recorded in half of the FA sessions that the teacher conducted independently with an average of 94% accuracy.

In an effort to alleviate the concerns of the length of FAs, several studies have examined a modified version of the traditional FA. As cited by Rispoli, Ninci, Nelly, and Zaini (2013), some modifications may include shorter condition lengths (Mueller et al., 2011) and latency-based FAs (Thomason-Sassi et al., 2011). An additional modified FA that may be the most appropriate is the trial-based FA (Sigafoos & Saffers, 1995). The trial-based FA may be the most appropriate modification to the traditional FA for a school setting because it can be embedded throughout natural activities, condition lengths are shorter, and it does not require the target behavior to be evoked more than one time in any test condition (Bloom et al., 2011). In Bloom et al. (2011), researchers compared the results of a researcher conducted trial-based FAs in a classroom setting to the results of a

standard FA in a clinical setting. Results indicated that the trial-based FA results matched that of the standard FA in seven of the ten participants and a trial-based FA was an accurate predictor of what function was maintaining challenging behaviors. LeJeune, Lambert, Lemons, Mottern, and Wisniewski (2018) trained teachers to conduct a trial-based FA in the natural setting which was used to inform treatment that was also implemented by the classroom teacher. In the study, results from the trial-based FA revealed the challenging behavior to be maintained by multiple functions and an appropriate intervention was created. The researchers used procedures described by Hagopian et al. (2002) to create an individualized levels system that was also implemented by the classroom teacher. This study suggests that classroom teachers can be trained to implement trial-based FAs and intervention procedures with fidelity.

After the function of a behavior has been determined, a variety of differential reinforcement procedures are available as a consequent strategy to decrease the target behavior. Differential reinforcement of alternative behavior (DRA) is a “procedure that involves systematically reinforcing behavior that is topographically dissimilar to, but not necessarily physically incompatible with, the behavior targeted for reduction” (Vollmer & Iwata, 1992, p. 398-399). Typically, while the alternative behavior is being reinforced, the targeted problem behavior is placed on extinction, or no longer reinforced (Vollmer, Roane, Ringdahl, & Marcus, 1995). While all differential reinforcement procedures are effective, DRA is found to be more efficient than procedures because the alternative behavior matches the function of the challenging behavior (LeGray et al., 2010). Flynn and Lo (2016) evaluated the effects of a teacher-implemented trial-based FA and DRA for six middle school age students diagnosed with autism spectrum disorder or emotional

behavior disorder who engaged in challenging behaviors. The topographies of the challenging behaviors included vocal outbursts, elopement, giggling, and self-stimulatory behavior. The trial-based FAs revealed that three of the students' challenging behaviors were maintained by escape, two challenging behaviors were maintained by attention, and one challenging behavior was maintained automatically. Appropriate alternative behaviors were chosen for each of the students as replacement behaviors and a DRA with teacher feedback was implemented for three of the six students. Results showed a decrease in rate of challenging behavior and an increase in rate of alternative behavior for all three students. The teachers' implementation of the DRA procedures was then implemented with the remaining three students without researcher feedback and similar results were reached.

DRA procedures are effective with a variety of populations, including populations with varying disabilities. Wright-Gallo, Higbee, Reagon, and Davey (2006) used DRA procedures to teach two students of average intelligence with emotional behavior disorder how to request a break appropriately and correctly request teacher attention. For both students, problem behavior decreased, and the appropriate alternative behavior increased during the DRA condition with a return to baseline levels when the intervention was removed. In addition to the DRA, the researchers included a plan to thin the schedule of reinforcement. At the beginning of the study, students' alternative behaviors were being reinforced on a continuous schedule of reinforcement, but by the end of the study the students' alternative behaviors were being reinforced during 75% of sessions. Teachers reported that this thinner schedule of reinforcement was feasible in their classrooms.

Interventions such as a DRA can be combined with other treatments that may include response cost (Alaimno, Seiverling, Anderson, & Sturmey, 2018) and response interruption (Hagopian, Gonzalez, Rivet, Triggs, & Clark, 2011). Alaimno et al. (2018) compared DRA to DRA with an escape extinction component plus response cost to evaluate the effects on food refusal. Results indicated that food and drink consumption were higher and inappropriate meal time behaviors were lower during the DRA with escape extinction condition. DRA has also been combined with response interruption to treat pica in individuals diagnosed with autism (Hagopian et al., 2011). Hagopian et al. (2011) conducted initial treatment sessions in session rooms at an inpatient unit but expanded the sessions to living areas and bedrooms in the inpatient unit and eventually to community settings. Participants were given noncontingent access to preferred items, alternative behaviors were reinforced on a continuous schedule of reinforcement, and pica attempts were interrupted by researchers redirecting participants to the alternative behavior. The treatment package was effective across all settings.

While the results of treatment packages have been promising in the reduction of challenging behaviors, many researchers are implementing these packaged interventions in controlled settings, as opposed to being applied by indigenous implementers in natural settings. There is also little evidence to suggest which intervention in a treatment package is the most effective or if the treatment packages could be broken down into smaller pieces to increase the feasibility of the intervention for implementers. Feasibility of teacher implementation (e.g., providing escape every 10 s to a student during instructional time) and the ability to conduct a FA in an uncontrolled, dynamic environment (e.g., a classroom) could account for some of the scarcity of literature

related to teacher implementation of interventions targeting challenging behaviors in classrooms. There is a gap in literature that assesses teacher implementation of trial-based FAs as well as the implementation of DRA procedures that would be considered feasible in a classroom with more than one student.

Section 2: Research Question

The purpose of this study was to expand research conducted by Flynn & Lo (2016) to (a) determine if the implementation of a trial-based FA by a classroom teacher can conclude maintaining functions of challenging behaviors in a natural setting, b) experimentally determine if the implementation of DRA by a classroom teacher is effective in increasing the percentage in which students with autism spectrum disorder (ASD) engaged in an alternative, replacement behavior for their target behavior, and c) evaluate the feasibility of a DRA intervention for a classroom teacher.

Section 3: Method

Participants

Students. Participants included two adolescent males enrolled in a public middle school that were served in the self-contained moderate to severe (MSD) special education classroom between 40%-80% of the school day. Participants were selected based on teacher report of challenging behaviors that were disruptive to the structure of the classroom. Inclusion criteria included the following: (a) eligibility for special education services in the MSD classroom, (b) high rates of socially-mediated aberrant behavior in which a function could be determined following a trial-based FA conducted by a classroom teacher in a natural setting, (c) in attendance for at least 80% of the current school year, and (d) parental consent. Student assent was not included in the inclusion criterion because the study was focused on behavior reduction and did not require the student to complete any tasks outside of a normal school routine. Participants were to be excluded from the study if an effective behavior intervention plan was already in place for the behavior of concern or if the researcher hypothesized that the maintaining function of the challenging behavior was automatic. The latter exclusion criterion was established because the classroom was not be equipped for an *alone* condition to be safely conducted during the trial-based FA.

Howard was a 14-year-old male in the eighth grade diagnosed with ASD. He received special education services in the MSD classroom 40%-80% of the school day. Additionally, he received speech therapy and occupational therapy through school services. Howard communicated verbally in one to two-word utterances, but based on

teacher report and direct observation, many of his vocalizations were echolalic in nature. His secondary communication modality was via an augmentative and alternative communication (AAC) device. Based on teacher report, Howard had his AAC available at all times of the day and could independently access it to make requests but required a verbal prompt to access it for other types of communication (e.g., greetings). At the time of the study, Howard's Individualized Education Program (IEP) academic goals included identifying and defining functional sight words and community signs; calculating functional math equations with a calculator and using Next Dollar strategy to pay for items in the community; and typing his personal information on an iPad. Howard met eligibility for Alternate Assessment. Communication goals included independently requesting items using a complete sentence, identifying familiar people by name, and accurately responding to greetings and familiar questions using his AAC. Howard had a history of eloping, dropping, property disruption, and aggression. However, many of these behaviors had not been observed in several months and a plan was in place that was successfully decreasing elopement. Based on teacher report and direct observation, Howard engaged in inappropriate self-touching (i.e., licking his nipples) at high rates during the school day across multiple environments; therefore, this behavior was selected as the target behavior.

Fred was a 12-year-old male in the sixth grade diagnosed with ASD. He received special education services in the MSD classroom 40%-80% of the school day. Additionally, he received speech therapy and occupational therapy through school services. Fred spontaneously communicated with teachers and peers by verbalizing four or more-word utterances and the length of his utterances had recently increased with the

use of fading scripts. Based on direct observation, Fred had the prerequisite skills to mand for items or attention and challenging behavior often followed being told no to the request. Academic goals on Fred's IEP included identifying and defining functional sight words and community signs; solving functional math equations with a calculator and using Next Dollar strategy to pay for items in the community; typing his personal information on an iPad; and completing independent chained work tasks with no more than one verbal prompt. Communication goals included identifying emotions and coping strategies and increasing social utterances with a script that would be faded over time. Based on teacher report, Fred has a history of property destruction, dropping, elopement, and crying. An effective plan had been developed that resulted in a decrease in the dropping and elopement. The property destruction was identified as his challenging behavior because of safety concerns. Fred had severe food allergies to milk, eggs, and peanuts. The property destruction included ripping any three-dimensional cardboard item, which included the destruction of full milk cartons resulting in emergency medicine (i.e., EpiPen) administration. Due to this behavior and the potential dangers associated with it, the IEP team decided his least restrictive environment for lunch would be the classroom.

Teacher. One teacher was included in the study who had an undergraduate degree in Special Education that included a focus in MSD. She had been teaching in a MSD classroom for three years. At the time of the study, she was enrolled in a Special Education master's program and had received several classes with a focus in behavior management. Prior to conducting any of the trial-based FAs or DRA sessions, the teacher was trained by the researcher in procedures and had to complete a fidelity check with a minimum of 90% accuracy.

Researcher. The primary researcher was in her second year as an Applied Behavior Analysis (ABA) graduate student. Her undergraduate degree was in Special Education with a focus in MSD and taught in a self-contained high school classroom for three years prior to the study.

Setting and Materials

Teacher trainings. Teacher trainings for trial-based FA procedures and DRA procedures were conducted in the MSD classroom during the teacher's planning period. The teacher was trained once on each set of procedures. Materials for each training included PowerPoints, handouts created by the researcher, and data sheets. Additional materials required for the trial-based FA training included a red and green card to signal if reinforcement would be available for the student.

Trial-based FAs. All sessions were conducted by the teacher in a 1:1 arrangement in the MSD classroom. During most sessions, there were four to five other students in the classroom receiving instruction from paraprofessionals. The times of day that data were collected varied for each participant based on teacher report of when the target behavior was likely to occur at a high frequency and feasibility for the class schedule. All sessions were trial-based, meaning they were trial lengths were shorter than that of a standard or brief FA and could be naturally embedded throughout classroom activities; however, the teacher chose to conduct sessions back to back for feasibility purposes until the end of the session. One trial-based FA was conducted for each participant with each test condition (i.e., attention, tangible, and escape) being tested twice in each session for a total of six test conditions per session. The control condition

lasted 1 min and each test condition lasted until challenging behavior occurred, or 3 min (Flynn & Lo, 2016). One session was conducted per participant each day over the course of five days. During sessions, materials varied for each participant depending on the individualized goals for each participant and individualized reinforcers. Task demands presented during the escape condition included money tasks or writing tasks for Howard and independent work boxes for Fred. Moderately preferred items presented during control conditions included a book or train for Howard and coloring materials for Fred. Both participants had access to an iPad as their highly preferred item during the control conditions preceding the tangible conditions. The hierarchy of preferred items was identified via teacher interview and direct observation. Additional items for each participant included Howard's AAC which was available during all trial-based FA and DRA sessions as well as a tissue box for Fred. Tissue boxes had previously been removed from the classroom and were placed on Fred's desk during sessions. Outside of sessions, the tissue box remained on the teacher's desk. The researcher was the primary data collector during trial-based FAs with an ABA graduate student collecting reliability data.

DRA sessions. All DRA sessions were conducted by the teacher in a 1:1 arrangement in the MSD classroom using trial-based materials similar to the trial-based FAs. Additionally, the number of other students in the room, time of day, and materials did not change from the trial-based FAs. Howard had access to his AAC during baseline and intervention sessions as well as moderately preferred materials (e.g., books), highly preferred items (e.g., iPad), and nonpreferred task demands (e.g., writing or math). During Fred's DRA sessions, the tissue box was placed on his desk during baseline and intervention sessions. Similar to Howard, Fred had access to moderately preferred items

(e.g., puzzles and coloring) as well as highly preferred items (e.g., iPad). The teacher collected data for each session while the researcher collected reliability and fidelity data.

Target Behaviors

Target behaviors were identified for each participant based on teacher interview, parent report, and approximately four hours of direct observation by the researcher. Teacher interviews were conducted by the researcher and involved open-ended questions as described by Hanley (2012). During direct observations, the researcher collected anecdotal data on the identified challenging behaviors. Anecdotal data were collected on an unstructured data sheet by the researcher. After data were collected for each participant, the researcher analyzed the data to hypothesize a function of the targeted behavior.

Howard. Howard's target behavior was identified as inappropriate self-touching defined as any instance or attempt in which he reached down or up his shirt with his hand and made contact with his nipple or pulled his shirt down and any part of his head (e.g., tongue) made contact with his nipple. Based on interviews and direct observation, the researcher hypothesized the behavior to be maintained by negative reinforcement in the form of escape from task demands.

Fred. Fred's target behavior was identified as property destruction defined as any instance or attempt in which he tears, rips, crushes, or crumples any item in his environment (e.g., milk carton, tissue box). Based on interviews and direct observation, the researcher hypothesized the behavior to be maintained by positive reinforcement in

the form of access to tangibles or negative reinforcement in the form of escape from demands.

Trail-based FA Measurement Systems

Following training of the trial-based FA procedures, the teacher role-played a trial-based FA with a graduate student while the researcher collected procedural fidelity and reliability data. Before implementing trial-based FAs with the participants, the teacher demonstrated a minimum fidelity of 90% accuracy in each test and control condition.

During the trial-based FAs, the researcher collected the occurrence or non-occurrence of the target behavior and latency to the target behavior for each participant in each condition (See Appendix A). The control condition and test condition made up one trial and each day consisted of two trials of each function. Each test condition (e.g., escape, tangible, and attention) was 3 min in length and was preceded by a 1 min control condition. One trial-based FA was conducted for each participant with each function being tested a total of ten times. After the FAs were conducted, the researcher graphed the percentage of target behavior during each condition and conducted a visual analysis of the graph. Any condition that was elevated by a minimum of 20% compared to the control condition of the trial-based FAs was determined to be a maintaining function that influenced the DRA procedures for each participant. The researcher considered a 20% increase in the test intervals compared to control intervals to be a significant enough of a change in level to be considered a maintaining function.

Trial-based FA Procedures

Teacher trial-based FA training. Teacher training was conducted in the classroom by the researcher during the teacher's planning period. The researcher began training by presenting the teacher with a handout and a PowerPoint. The beginning of the training provided a rationale for conducting a trial-based FA (i.e., to determine the function of the behavior and use that information to inform an intervention as described by Flynn & Lo, 2016). Using a printout and PowerPoint, the researcher explained each condition in the trial-based FA. Conditions explained included control preceding each test interval, tangible, attention, and escape. After the rationale and conditions were described, the researcher modeled each condition with a graduate student research assistant, then live-coached the teacher through each condition during a role-play session with the graduate student. After researcher provided coaching during a role-play session, the researcher completed a fidelity check on the teacher's trial-based FA procedures. The teacher independently role-playing the procedures in each condition with the graduate student. During the independent role-play session, the graduate student engaged in challenging behaviors similar to the target behaviors defined for the participants so the teacher could practice response procedures during each condition. Prior to implementing the trial-based FA with participants, the teacher was required to implement procedures independently with a minimum of 90% accuracy (see Appendix B). The role-play session consisted of one control condition, one attention condition, one tangible condition, and one escape condition. The total duration of the trial-based FA training was 22 min and the teacher scored 100% on fidelity in the first independent role-play session.

Trial-based FA. Each trial-based FA began with a control condition that lasted 1 min followed by the test condition that lasted until challenging behavior occurred, or a maximum of 3 min (Flynn & Lo, 2016). One trial-based FA was conducted over 5 days with each function trial being assessed twice in a session (Flynn & Lo, 2016). During the trial-based FA, the researcher used cards to signal the teacher if reinforcement was available to the participant during that condition. During control conditions, the researcher held a red card to signal to the teacher that no reinforcement was to be provided for the target behavior. The red card remained visible during the test conditions until the student engaged in the target behavior. During that time, the researcher turned the card to “green” to signal that reinforcement should be provided. As soon as reinforcement needed to be restricted again, the researcher turned the card back to red. While the signal card was not used in Flynn & Lo (2016), it was determined appropriate for this study to prevent potential procedural fidelity given time constraints. It was also deemed appropriate because the teacher implementation of trial-based FA procedures was not the primary research question. The researcher collected primary data by recording the occurrence or non-occurrence of the target behavior in each interval as well as latency to each target behavior. The researcher also collected procedural fidelity on the teacher while the graduate student assistant collected reliability on the researcher’s data on occurrences of challenging behavior.

During all trial-based FA sessions, Howard had access to his AAC so he could mand appropriately if he chose to do so and the placement of the tissue box was on Fred’s desk. It typically remained on the teacher’s desk, however, because the teacher reported a history of elopement, it was decided that the tissue box should remain on his

desk during sessions to prevent elopement. The condition types for the trial-based FA were as follows:

Attention. The control condition that preceded the attention condition allowed the participant access to moderately preferred tangibles, access to teacher attention, and no demands were pressed. If the participant engaged in the target behavior during control, the teacher blocked and ignored the behavior. Following a 1 min control condition, the environment was arranged by the teacher diverting her attention by physically orienting away from the student and stating, “I have to go over here and do some work.” Along with physically moving away from the participant, she engaged with adults or other students in the room. She maintained close proximity (i.e., within 10 ft) to the student, so reinforcement could be delivered immediately contingent on the target behavior. The teacher did not provide any verbal or physical attention to the student unless the student engaged in the target behavior. Attention was not provided even if the participant engaged in appropriate bids for attention (e.g., “Hey, come talk to me”). Contingent on the participant engaging in the target behavior, the teacher immediately delivered rich attention (e.g., physical contact and a verbal reprimand that lasted approximately 15 s). The attention provided mimicked what typical attention looked like in the classroom which was verbal reprimand (e.g., “We do not do that!”) and physical attention (e.g., a rub on the back). The trial ended if the participant engaged in the challenging behavior or at the conclusion of the 3 min interval.

Escape. The control condition that preceded the escape condition allowed the participant access to moderately preferred tangibles, access to teacher attention, and no demands were pressed. If the participant engaged in the target behavior during control,

the teacher blocked and ignored the behavior. Following a 1 min control condition, environment was arranged by the teacher pressing a demand. Demands placed varied for both participants depending on what was considered a non-preferred task based on teacher report. The demands pressed for Howard were math related and demands pressed for Fred were independent work boxes that focused on fine motor skills (e.g., assembling flashlights). The teacher used three-step guided compliance to ensure that the student complied with the demand. Three-step guided compliance consisted of a verbal, model, and physical prompt with a 5 s wait time between each level of prompt. Contingent on the participant engaging in problem behavior, the teacher removed the demand, stated that work was over (e.g., “Okay, we don’t have to work right now”), and ended the trial. The teacher continued to press demands until the participant engaged in problem behavior or until the 3 min interval ended.

Tangible. The control condition that preceded the tangible condition allowed the participant access to highly preferred tangibles, access to teacher attention, and no demands were pressed. If the participant engaged in the target behavior during control, the teacher blocked and ignored the behavior. Following a 1 min control condition, the teacher arranged the environment by restricting the item and stated it was no longer available. The item remained in view and the teacher interacted with it so it would light up and make noise. Highly preferred items were determined based on teacher interview and direct observation. If the participant engaged with another item after the highly preferred item was restricted, he was allowed access for approximately 10 s before that item was also restricted. Contingent on the participant engaging in the target behavior, the highly preferred item was returned to the student and the trial ended. If the participant

did not engage in the target behavior, the condition ended at the conclusion of the 3 min interval.

DRA Measurement Systems

Following the trial-based FA for both participants, the teacher role-played a DRA with a graduate student while the researcher collected procedural fidelity and reliability data. Before implementing DRA sessions with the participants, the teacher demonstrated a minimum fidelity of 90% accuracy in each test and control condition.

During DRA sessions with the participants, data were collected by the classroom teacher recording the occurrence or non-occurrence of target behaviors and alternative behaviors during each trial. The teacher also collected latency data to the target behavior (See Appendix C).

Alternative Behaviors

Along with defining the aberrant behavior that was targeted to decrease, a more socially-acceptable, alternative behavior was identified for each participant to replace the challenging behavior. The alternative behavior was defined following the trial-based FAs.

Howard. Howard's alternative behavior to replace inappropriate self-touching was manding for the desired tangible (e.g., "I want the iPad"), manding for attention (e.g., "Come talk to me"), or requesting a break (e.g., "I want a break") depending on the condition. Mands via the AAC as well as verbal communication were honored during all DRA sessions. Verbalized mands were honored if Howard's request was two or more words. During all sessions, the AAC was available, however, during intervention

sessions, the appropriate mand was the only available button on the AAC device for Howard to access.

Fred. Fred's alternative behavior to replace the property destruction was tolerating being denied access to a highly preferred item by engaging with another activity or waiting without engaging in property destruction for 1 min. During each trial, the highly preferred item would be restricted, and he was told he could get the item back by engaging with other items. The teacher also stated the contingency that if he destroyed the box, he would not re-gain access to the iPad.

Independent Variable

The independent variable of the primary research question was the teacher implementation of DRA procedures targeted to systematically decrease inappropriate behaviors and increase appropriate behaviors that serve the same function. During the DRA sessions, the teacher reinforced alternative behaviors on a continuous schedule and placed targeted behaviors on extinction by withholding access to the maintaining reinforcement.

Experimental Design

A different single case design was used for each participant given the differences in functions that maintained the challenging behavior. A multiple baseline across behaviors with an embedded ABAB withdrawal research design in the first tier and second tier was used for Howard and an ABAB withdrawal design was used for Fred to assess the effects of a classroom teacher implementing DRA procedures in their classrooms to increase alternative behaviors.

Howard. A single case multiple baseline across behaviors research design demonstrates a functional relation by showing changes in the dependent variable at three different points in time (Gast & Ledford, 2014). A multiple baseline across behaviors design was used to control for instability and, prior to the start of the study, the researcher interviewed the teacher to control for history. The results of Howard's trial-based FA indicated his target behavior was maintained by access to attention, access to tangibles, and escape from demands. Therefore, because the DRA procedures were applied to three different behaviors (e.g., manding for a tangible, manding for attention, and manding for a break), a time-lagged design was deemed the most appropriate design to demonstrate control. Baseline data were simultaneously collected in all three tiers for a minimum of five sessions and until data were stable in all tiers. Tiers were randomized prior to the start of baseline sessions. After baseline data were stable, the intervention was introduced in the first tier (i.e., escape). Once Howard engaged in the alternative behavior in the first tier with 100% independence for two consecutive sessions and baseline data in the subsequent tiers were stable, the independent variable was introduced in the second tier (i.e., attention). Behavioral covariation occurred in tier three (i.e., tangible), so it was determined that a withdrawal design (i.e., ABAB design) would be embedded into the first and second tiers to establish a functional relation by demonstrating changes in level of the alternative behavior when the intervention was introduced, withdrawn, and then introduced again. Reliability data were collected 75% of sessions to control for instrumentation and procedural infidelity.

Fred. A single case ABAB withdrawal research design demonstrates a functional relation by showing changes in the targeted, reversible behavior at three separate points

in time (Gast & Ledford, 2014). The design was chosen for Fred because only one set of DRA procedures would be taught given one function was identified by the trial-based FA as the maintaining function of his challenging behavior. The design began by the teacher collecting baseline data of the occurrence or non-occurrence of the alternative behavior (e.g., tolerating a denial) during control trials and test trials for a minimum of five sessions. A secondary dependent variable collected was the latency to the target behavior (e.g., property destruction). After baseline data of the alternative behavior were stable, the researcher introduced the independent variable (i.e., DRA procedures) and evaluated the changes in the dependent variable by visually analyzing trend, stability, and level of the data. The researcher then systematically removed the independent variable to analyze if the levels of the dependent variable returned to the baseline levels. Once levels in the alternative behavior were stable and a minimum of five sessions had been conducted during the return to baseline condition, the intervention was then re-introduced to ensure the intervention was in place before the study ended. When the intervention was reintroduced, the researcher included a plan to thin the schedule of reinforcement. After a minimum of five session and stable data, the amount of time that Fred had to wait to gain access to the tangible increased by one min. This design was selected for Fred because the dependent variable was a reversible behavior that could revert to original baseline levels given the withdrawal of the intervention. This design also allowed Fred to receive the intervention within a reasonable time frame and the study ended in the intervention phase. The withdrawal of the intervention was systematic, and it was re-introduced quickly following data stability in the second baseline condition. Prior to the start of the study, the researcher interviewed the teacher about previous interventions that were in

place for Fred to control for history and the overall length of the study was short in nature to control for maturation. Reliability data were collected 76% of sessions to control for instrumentation and procedural infidelity.

DRA Procedures

Teacher DRA training. After the function of each participant's behavior was concluded, the researcher determined an alternative behavior for each participant that served the same function as the target behavior. Communication and any prerequisite skills required for the alternative behavior were discussed with the teacher to ensure that the alternative skills were in the participant's repertoire. Similar to the trial-based FA training, the researcher explained DRA procedures and the rationale as a set of procedures designed to decrease inappropriate behaviors while increasing appropriate behaviors. The researcher trained the teacher on appropriate schedules of reinforcement of the alternative behavior (e.g., continuous reinforcement at the beginning of the study) and appropriate extinction procedures (e.g., not giving attention during an attention test). The teacher had access to a handout and PowerPoint created by the researcher during the training. After the definition and rationale, the researcher modeled the DRA procedures for each participant with a graduate student assistant and then live coached the teacher through the procedures with the graduate student. Prior to implementing the DRA with participants, the teacher independently role-played DRA procedures for each participant with the graduate student with a minimum of 90% accuracy (See Appendix D). During role-play sessions, the teacher collected the occurrence or non-occurrence of the alternative behavior and target behavior as well as latency to the target behavior. The researcher collected procedural fidelity and reliability data. The total duration of the DRA

training was 28 min and the teacher scored 100% on fidelity in the first independent role-play session.

Baseline.

Howard. The initial baseline condition (A_i) was conducted using the same procedures as the trial-based FAs for that specific function. Each session consisted of six trials and only maintaining functions of the targeted behavior were tested. Howard's target behavior was determined to be maintained by positive reinforcement in the form of access to attention, positive reinforcement in the form of access to tangibles, and negative reinforcement in the form of escape from task demands. Therefore, two trials of each function were tested during each baseline session for a total of six trials. Howard had his AAC available during all sessions. In the escape trials, the escape control interval as described in the trial-based FA procedures was conducted for 1 min. Following the control, the teacher arranged the environment by pressing a non-preferred demand. Contingent on Howard engaging in the target behavior or the alternative behavior, the demand was removed for 30 sec. If Howard did not engage in the target behavior or the alternative behavior, the trial ended after 3 min. In the attention trials, the attention control interval was conducted as described in the trial-based FA procedures and lasted for 1 min. Following the control, the teacher removed her attention by saying, "I have to go over here, I have some work to do." Contingent on the target behavior or the alternative behavior, the teacher provided rich attention in the form of a short reprimand (e.g., "No, we don't do that!") and physical attention for approximately 15 sec. If Howard did not engage in either behavior, the trial ended after 3 min. In the tangible trials, the tangible control interval was conducted as described in the trial-based FA procedures and

lasted for 1 min. Following the control, the teacher removed the tangible by saying, “I need to take this.” Contingent on the target behavior or the alternative behavior, the teacher re-introduced the tangible for approximately 30 sec. If Howard did not engage in either behavior, the trial ended after 3 min. After data were stable in baseline sessions for a minimum of five sessions, the DRA intervention was introduced for each participant.

Fred. Similar to Howard, Fred’s DRA baseline sessions were conducted similar to the trial-based FA. Fred’s targeted behavior was determined to be maintained solely by positive reinforcement in the form of access to tangibles; therefore, six tangible trials were conducted each session. A 1 min tangible control interval as described in the trial-based FA procedures was conducted immediately before each 3 min test condition.

During the test, contingent on the target behavior or alternative behavior, the participant gained access to the restricted reinforcement (e.g., contingent on the participant engaging in the target behavior during the attention condition, attention was provided). The teacher recorded the occurrence or nonoccurrence of target behaviors and alternative behaviors during each control and test interval. After data were stable in baseline sessions for a minimum of five sessions, the DRA intervention was introduced for each participant.

Intervention.

Howard. See Table 1 for a description of Howard’s conditions. When the intervention (B_i) was introduced, the teacher used DRA procedures to reinforce the alternative behavior (e.g., manding for attention, a tangible, or a break) and placed target behaviors (e.g., inappropriate self-touching) on extinction. After the environment had been arranged in each test interval as described in the trial-based FA procedures, Howard’s inappropriate self-touching was no longer reinforced, and he could only gain

access to attention, a tangible, or escape from a task demand if he engaged in the appropriate mand. At the beginning of each intervention session, the alternative behavior was described to Howard, the new contingency was vocally stated (e.g., “It’s time to do work, if you want a break use your voice to say, ‘I want a break.’”) and paired with a visual. The visual for Howard was the appropriate mand opened on the AAC. If Howard engaged in the defined alternative behavior, reinforcement was immediately presented for a predetermined amount of time. If Howard engaged in the alternative behavior during the attention condition, rich attention was provided for approximately 20 s before ending the trial. If Howard engaged in the alternative behavior during the escape condition, the demand was removed approximately 30 s before ending the trial. Finally, if Howard engaged in the alternative behavior during the tangible condition, the tangible was re-introduced for approximately 30 s before ending the trial. If Howard engaged in the target behavior during any condition, the teacher blocked the behavior, waited for 10 s of calm, and then restated the contingency. If Howard then engaged in the alternative behavior, the consequence was identical to if he had engaged in the alternative behavior independently. If he engaged in the alternative behavior following the prompt, the occurrence was recorded with a note that it followed the model. Only trials in which he independently engaged in the alternative behavior were recorded on the graph.

After baseline data were stable in all tiers for Howard, the DRA intervention was introduced in the first tier (escape) while all other tiers (attention and tangible) remained in baseline. Intervention was introduced in subsequent tiers contingent on mastery of the alternative behavior which was set at two consecutive sessions of 100% independent responding and a stable trend in all baseline conditions. After the intervention was

introduced in the first tier and data were stable for a minimum of five sessions, the intervention was withdrawn to assess the effects on the dependent variable. After a minimum of five sessions, or until data were stable, the intervention was reintroduced. The withdraw procedures occurred in the first two tiers (i.e., escape and attention), but not in the third tier (i.e., tangible). The covariation observed in the third tier during the initial baseline sessions influenced the researcher to withdraw the intervention in the first two tiers. A functional relation could not be established because the student was engaging in the alternative behavior in tangible tier before the intervention had been introduced. By withdrawing the intervention in the first two tiers, a functional relation could be established for both the escape and attention tiers.

Table 1

Howard's DRA Conditions

Condition	Length	Environmental arrangement	Response to target behavior	Response to alternative behavior
Attention Control	1 min	Access to moderately preferred items, no demands, teacher attention	Block and ignore inappropriate self-touching	N/A
Attention	3 min, or until alternative behavior occurred	Attention diverted	Block until 10 s of calm, restate contingency	Access to rich attention for 20 s
Escape Control	1 min	Access to moderately preferred items, no demands, teacher attention	Block and ignore inappropriate self-touching	N/A

Escape	3 min, or until alternative behavior occurred	Demand presented	Block until 10 s of calm, restate contingency	Removal of task demand for 30 s
Tangible Control	1 min	Access to highly preferred items, no demands, teacher attention	Block and ignore inappropriate self-touching	N/A
Tangible	3 min, or until alternative behavior occurred	Highly preferred tangible removed	Block until 10 s of calm, restate contingency	Access to highly preferred tangible for 30 s

Fred. See Table 2 for a description of Fred’s conditions. When the intervention (B.) was introduced, the teacher used DRA procedures to reinforce the alternative behavior (e.g., tolerating a denial) and placed his target behavior (e.g., property destruction) on extinction. After the environment had been arranged following the one min tangible control interval (as described in the trial-based FA procedures) by the teacher removing the highly preferred item, Fred’s property destruction was placed on extinction and only engaging with another activity or waiting for one min allowed him access to a highly preferred item (e.g., the iPad). At the beginning of each intervention session, the alternative behavior was described to Fred by vocally stating the contingency (e.g., “I need to take the iPad, you can have the puzzle or color. If you touch the tissue box, you do not get the iPad”) paired with a visual. The visual for Fred was a card with a large X through a three-dimensional box. If Fred engaged in the defined alternative behavior, reinforcement was immediately presented for a predetermined amount of time (i.e., 30 s). If Fred engaged in the target behavior during any condition, the teacher

blocked the behavior, waited for 10 s of calm, restated the contingency, and reset the timer. The timer could be re-set an infinite number of times if necessary. Fred could not access the tangible until he had not engaged in the target behavior a minimum of 1 min during typical sessions or 2 min during maintenance sessions. When engaged in the alternative behavior, the consequence was identical to if he had engaged in the alternative behavior independently. If he engaged in the alternative behavior following the prompt, the occurrence was recorded with a note that it followed the model. Only trials in which he independently engaged in the alternative behavior were recorded on the graph. After there was stable responding in the second intervention condition, the researcher probed maintenance and generalization. During maintenance sessions, the same procedures as described above were used, however, Fred could only access reinforcement after 2 min. After two consecutive sessions at 100% engagement in the alternative behavior, the researcher probed for generalization by having the teacher run sessions in the cafeteria instead of the classroom. It was during a time that no other students were in the cafeteria and no real milk cartons were accessible.

Similar to baseline, intervention sessions occurred during the time of day that was most likely he would engage in problem behavior and allowed for the teacher work 1:1 with him. The first intervention condition occurred a minimum of five sessions and until data were stable. After data were stable in Fred's initial intervention condition, the intervention was withdrawn until data were stable for a minimum of five session. It was decided to not shorten the length of the condition because there were no safety concerns related to Fred's behavior and the presented stimuli (e.g., a tissue box or origami milk carton). Fewer sessions may have occurred in the second baseline condition if there were

potential safety concerns for ethical purposes. Finally, the intervention was introduced for a second time using the same procedures as described above.

Table 2

Fred's DRA Conditions

Condition	Length	Environmental arrangement	Response to target behavior	Response to alternative behavior
Tangible Control	1 min	Access to highly preferred items, no demands, teacher attention	Block and ignore property destruction	N/A
Tangible	Until alternative behavior occurred	Highly preferred tangible removed	Block until 10 s of calm, restate contingency	Access to highly preferred tangible for 30 s

Inter-observer agreement (IOA)

Trial-based FA. IOA data were collected by a graduate student assistant with experience in data collection and who had been trained by the researcher on procedures. IOA data were collected a minimum of 20% of trial-based FA sessions for each participant. Using the same data sheet as the researcher, the secondary data collector recorded the occurrence or non-occurrence of the alternative behavior and the target behavior as well as the latency to target behaviors during each trial (See Appendix E). IOA data were calculated using interval by interval agreement for the occurrence or non-occurrence of alternative and target behavior data as well as latency data.

The researcher and data collector recorded the occurrence or non-occurrence of the target behavior during each trial. Latency data were scored as an agreement if the

time recorded for the researcher and secondary data collector fell within a 3 s window. Occurrence or non-occurrence of the target behavior was scored as an agreement if the primary data collector and secondary data collector both recorded the occurrence or non-occurrence of the target behavior. IOA for occurrence and non-occurrence as well as latency was then calculated by dividing the number of agreements within each interval by the number of agreements plus the number of disagreements and multiplying by 100 (Cooper et al., 2007). Following each session, any disagreements in IOA data were reviewed before the next session was conducted. If reliability fell below 80% for one session, the researcher and secondary data collector reviewed procedures and operational definitions of behaviors. Agreement scores for occurrence or non-occurrence data collection averaged 100% across both participants and agreement scores for latency data collection averaged 88% (range, 75% to 100%).

DRA. IOA data were collected by the researcher a minimum of 20% of sessions in each condition. Training did not occur past the role-playing fidelity check; therefore, the teacher was the primary data collector and the researcher was the secondary data collector. Using the same data sheet as the teacher, the researcher recorded the occurrence or non-occurrence of the target behavior and the alternative behavior in each interval (see Appendix F). IOA data were used to control for observer drift and scored using point by point agreement for both occurrence and non-occurrence data as well as latency data. IOA was calculated by dividing the number of agreements within each interval by the number of agreements plus the number of disagreements and multiplying by 100. Following each session, any disagreements in IOA data were reviewed before the next session was conducted. If reliability fell below 80% for one session, the teacher

retrained the teacher in DRA procedures and operational definitions of behaviors were reviewed. IOA data were collected during 67% of Howard's sessions with an average agreement of 99% (range, 96%-100%) for occurrence or non-occurrence of alternative behavior and an average agreement of 96% (range, 75%-100%) for latency to the target behavior. IOA data were collected during 68% of Fred's sessions with an average agreement of 100% for occurrence or non-occurrence of alternative behaviors and an average agreement of 99% (range, 83%-100%) for latency to the target behavior.

Procedural Fidelity

Trainings. Procedural fidelity data during training sessions were collected by a graduate student trained on the procedures during all trial-based FA trainings and DRA trainings. Prior to implementing trainings, the researcher and secondary data collector reviewed training procedures. The secondary data collector recorded the occurrence or non-occurrence of each planned step by the primary researcher (see Appendix G).

Procedural fidelity was calculated by dividing the number of steps completed by the number of steps planned for training and multiplying by 100. Following each session, each non-occurrence of a step in the procedures was discussed with the researcher. If procedural fidelity fell below 80%, the researcher and secondary data collector reviewed training procedures. Procedural fidelity was scored at 100% for both training sessions.

Trial-based FA. Procedural fidelity during trial-based FAs were collected by the researcher a minimum of 20% of sessions. Procedures during trial-based FAs were taught to mastery during training sessions as evidenced by the role-playing fidelity check. The researcher recorded the teacher's occurrence or non-occurrence of each planned step (see Appendix H). Procedural fidelity was calculated by dividing the number of steps

completed by the number of steps planned for training and multiplying by 100. Following each session, each non-occurrence of a step in the procedures was reviewed with the teacher and if procedural fidelity fell below 80%, the teacher was retrained in trial-based FA procedures. Procedural fidelity was collected in 80% of sessions with an average score of 98% (range, 89% to 100%).

DRA. Procedural fidelity data during DRA sessions were collected by the researcher a minimum of 20% of sessions. Procedures during DRA sessions were taught to mastery during training sessions as evidenced by the role-playing fidelity check and no further training was provided past the role-playing fidelity check. The researcher recorded the occurrence or non-occurrence of each planned step of the DRA sessions (see Appendix I). Procedural fidelity was calculated by dividing the number of steps completed by the number of steps planned for training and multiplying by 100. Following each session, each non-occurrence of a step in the procedures was reviewed with the teacher. If procedural fidelity fell below 80%, the teacher was retrained in DRA procedures. Procedural fidelity was collected in 67% of Howard's sessions with an average score for fidelity being 98% (range, 93%-100%). Procedural fidelity was collected in 68% of Fred's sessions with an average score for fidelity being 99% (range, 94%-100%).

Section 4: Results

Trial-based FA Results

Howard. During the trial-based FAs, Howard engaged in the target behavior during 0% of attention control intervals and 40% of attention intervals. He engaged in the target behavior during 10% of the escape control intervals and 70% of escape intervals. Finally, he engaged in the target behavior during 0% of tangible control intervals and 50% of tangible intervals. The researcher determined that Howard's target behavior was maintained by positive reinforcement in the form of access to attention, positive reinforcement in the form of access to tangibles, and negative reinforcement in the form of escape from demands. Although the behavior occurred most often in the escape condition, when all three functions are compared to their own control interval, all three show at least a 20% increase in the target behavior. The average length of Howard's trial-based FAs was 21 min with a total duration for all five sessions being 103 min. See Fig. 1 for results of Howard's trial-based FA.

Fred. During the trial-based FAs, Fred engaged in the target behavior during 10% of attention control intervals and 10% of attention intervals. He engaged in the target behavior 0% of escape control intervals and 0% of escape intervals. Finally, he engaged in the target behavior during 0% of tangible control intervals and 60% of tangible intervals. The researcher determined that access to tangibles was the only socially-mediated function maintaining Fred's behavior, as it was the only function that demonstrated at least a 20% increase in rate of the target behavior when compared to control. Although the percentage of engagement in the target behavior was elevated during 10% of the attention control conditions, it accounted for only one attention control

interval. Following the engagement in the target behavior during the attention control interval, the control was modified to include higher rates of noncontingent teacher attention and Fred did not engage in the target behavior during the attention control again. This modification justified attention not being a maintaining function of his target behavior. The average length of each trial-based FA for George was 23 min. Total duration could not be calculated because it was recorded for only three of the five sessions. See Fig. 1 for Fred's results of the trial-based FA.

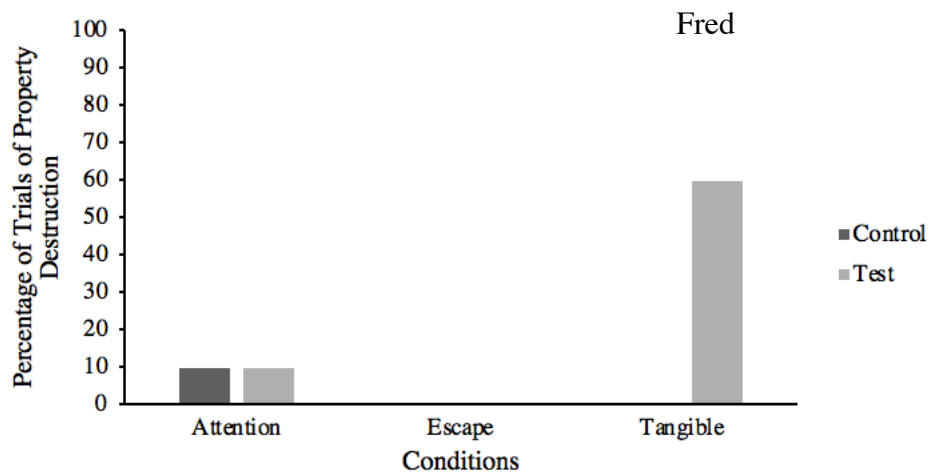
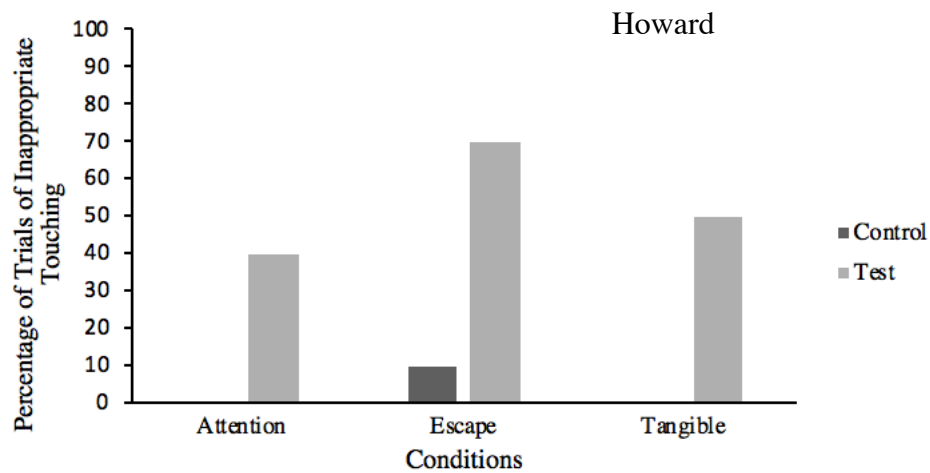


Figure 1. Trial-based FA results for both participants

DRA Results

Howard. See Fig. 2 for Howard's DRA graph. The data paths represent the percentage of intervals that Howard engaged in the alternative behavior during each session and the bar graphs represent the percentage of intervals that he engaged in the target behavior during each session. In tier one, the escape-maintained tier, Howard engaged in the alternative behavior 0% of all initial baseline sessions. During the initial eight baseline session, he engaged in the target behavior 100% of intervals in three session, 50% of intervals in four sessions, and 0% of intervals in one session. Experimental decisions were based on the percentage of engagement in the alternative behaviors (i.e., the line graphs); therefore, the intervention was introduced in session nine when baseline data were stable in all tiers. Once the intervention was introduced in the escape tier, there was an immediate and abrupt change in level from 0% engagement in the alternative behavior during intervals to 50% engagement in the alternative behavior during intervals. Levels remained at 50% until the eleventh session and there was a level increase to 100% engagement in the alternative behavior. Mastery criterion was set at 100% engagement in the alternative behavior for two consecutive sessions and was reached in session eleven. There was a decrease in level from 100% to 50% in the alternative behavior during session thirteen with an immediate return to 100% for the next two sessions. During the initial intervention session, Howard engaged in the target behavior during 50% of intervals for two of the seven sessions. Data stabilized and the intervention was withdrawn during session sixteen. An immediate and abrupt change in level was observed from 100% to 0% with a zero-celerating trend for all five sessions.

During the withdrawal, the alternative behavior returned to levels observed in the initial baseline condition. Howard engaged in the target behavior 50% of intervals in two of the five sessions. Finally, the intervention was reintroduced and the level in the alternative behavior had an immediate and abrupt change to 100% responding with a zero-celerating trend. There were no occurrences of the target behavior in the final condition.

In the attention tier, or the second tier, there was a zero-celerating trend at 0% engagement in the alternative behavior during all baseline sessions. Howard engaged in the target behavior 100% of intervals during four sessions, 50% of intervals during four sessions, and 0% of intervals during four sessions. After mastery criterion had been met in tier one and the remaining tiers showed stable baseline data, the intervention was introduced in tier two. Contingent on the introduction of the intervention there was an immediate and abrupt change in level from 0% to 100% engagement in the alternative behavior. Data remained stable at 100% for five consecutive sessions and there were no occurrences of Howard engaging in the target behavior. The intervention was withdrawn during the nineteenth session and there was one data point that overlapped with the intervention condition; however, data show a decelerating trend and levels returning to the initial baseline condition levels by session twenty-one. Data remained stable at 0% responding through session twenty-three. The intervention was re-introduced with an immediate and abrupt change in the alternative behavior from 0% to 100% and no occurrences of the target behavior.

In the tangible tier, or tier three, data were variable from session one to session six ranging from 0% engagement in the alternative behavior to 100% engagement in the alternative behavior. Data remained stable from session six to thirteen at 0% engagement

in the alternative behavior, however, there was an increase in level from session thirteen to session fourteen from 0% to 100% engagement in the alternative behavior. From session fourteen to twenty-one, data were variable between 50% and 100% engagement in the alternative behavior. Data remained stable at 100% from session twenty-one to twenty-six. The increase in the alternative behavior without intervention being introduced may be explained by a history effect including three changes in medication over the course of the study or previous exposure to manding for tangibles during speech therapy.

Average latency to the target behavior was collected as a secondary variable. If Howard did not engage in the target behavior during the trial, the maximum latency to the target behavior would be 180 sec (i.e., 3 min). During the initial baseline condition, the latency to the target behavior in the first tier averaged 56 s (range of 15 s to 180 s). Howard did not engage in the target behavior for one of the eight sessions (12.5%) in baseline. Upon introduction of the independent variable, latency increased to an average of 163 s (range 115 s to 180 s). Howard did not engage in the target behavior for five of the seven sessions (71.4%). After the intervention was withdrawn, the average latency to the target behavior decreased to 155 s (range 114 s to 180 s). He did not engage in the target behavior three of the five sessions (60%) during the second baseline condition. DRA sessions for Howard averaged 18 min (range, 13-24 min).

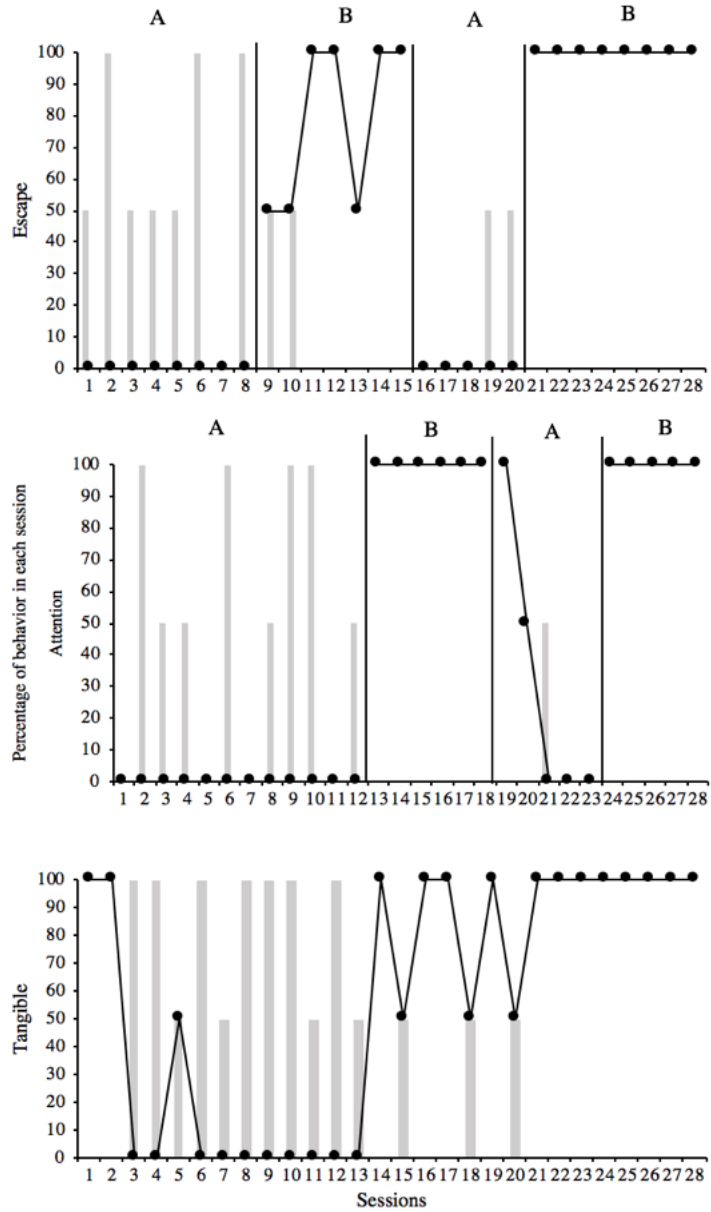


Figure 2. Howard's DRA graph. The line graph represents percentage of engagement in the alternative behavior during each session and the bar graph represents percentage of engagement in the target behavior during each session.

Fred. See Fig. 3 for Fred's DRA graph. The data paths represent the percentage of intervals that Fred engaged in the alternative behavior during each session and the bar graphs represent the percentage of intervals that he engaged in the target behavior during each session. Similar to Howard, experimental designs were made based on the

percentage of the alternative behavior, not the target behavior. During the initial baseline session, Fred had a zero-celerating trend of 0% engagement of the alternative behavior during all sessions. In the same condition, Fred engaged in the target behavior 100% of intervals in each condition. After the DRA intervention was introduced, there was an immediate change in level to 100% engagement in the alternative behavior and the data remained stable at 100% for five consecutive sessions. The percentage of intervals in each session Fred engaged in the target behavior also had an immediate and abrupt change in level from 100% to 0%. Upon withdrawal of the intervention, there was an immediate level change and data returned to 0% for five sessions. Percentage of intervals in each session that he engaged in the target behavior also returned to similar levels compared to the initial baseline condition. The intervention was introduced again, and levels returned to 100% engagement in the alternative behavior for five consecutive sessions. In the twenty-first session, the researcher began to thin the schedule of reinforcement. Fred's tolerant response increased from 1 min to 2 min in each trial. Data remained at 100% engagement in the alternative behavior for each maintenance session until mastery criterion had been reached. Once mastery criterion was reached on a thinner schedule of reinforcement, the stimuli changed from a tissue box to an origami milk carton. The origami milk carton had never been in contact with any dairy products and, therefore, was not a safety concern. Two sessions with the new stimulus were conducted and Fred maintained his levels of engagement in the alternative behavior for both sessions. Once mastery criterion was met for the stimulus generalization, Fred completed a maintenance session to probe for generalization in a different setting (e.g., the

cafeteria). During the generalization session to the cafeteria, Fred’s alternative behavior maintained at 100% during all trials and he did not engage in the target behavior.

During the initial baseline condition, Fred’s average latency to the target behavior averaged 3 s (range, 2 s to 4 s). Fred engaged in the target behavior for every session (100%). When the intervention was introduced, latency increased to 180 s, or the maximum latency possible, for each session as Fred did not engage in the target behavior (0%). Upon removal of the intervention, latency decreased to the same levels as the initial baseline condition and averaged 3 s (range, 2 s to 6 s). Similar to the first baseline condition, he engaged in the target behavior during each session (100%). Latency levels increased when independent variable was introduced again to 180 s each session and zero occurrences of the target behavior in the condition. DRA sessions for Fred averaged 19 min (range, 7-28 min).

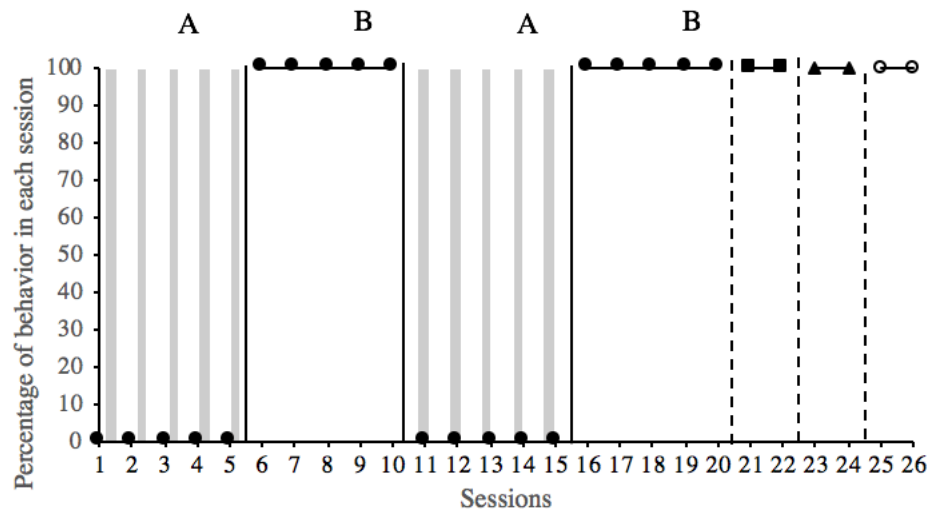


Figure 3. Fred’s DRA graph. The line graph represents percentage of engagement in the alternative behavior during each session and the bar graph represents percentage of engagement in the target behavior during each session. The squares represent sessions that included a thinner schedule of reinforcement, the triangles represent sessions with different stimuli presents, and the open circles represent sessions that occurred in the cafeteria.

Feasibility and Social Validity

At the completion of the study, the teacher completed a Likert-type scale that addressed the feasibility of the procedures as well as the social validity of the study. The scale was a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). The teacher reported that she strongly agreed to the following statements: a) The trial-based FA and DRA procedures were easy to learn, b) I will apply these procedures to other students in the future, and c) The DRA increased Fred's alternative behavior while decreasing his target behavior. She reported a neutral rating (i.e., score of 3 out of 5) to the procedures being easy to implement in the classroom and neutral to the DRA increasing Howard's alternative behavior while decreasing his target behavior. She reported being neutral on the feasibility of implementing of procedures in the classroom because it was difficult to devote all of her attention to one student, even if it was for such a short amount of time. For example, during one session a student not in the study had a seizure and the teacher had to end the session early for safety concerns. In an open-ended question, she was asked to add any notes describing what she liked about the study as well as what she might change for the future. She reported that her prior knowledge of the procedures may have influenced the duration of the trainings and trainings for future teachers may need to be extended. Additionally, she stated that the trial-based FA is the most efficient, organized, and quick way of determining the function of a behavior.

Section 5: Discussion

The primary purpose of this study was to evaluate if DRA procedures implemented by a teacher in a classroom would increase the rate of an alternative behavior that was taught to replace an aberrant behavior. As secondary questions, the study also examined teacher implementation of trial-based FAs to determine the function of the challenging behavior and the feasibility of a teacher implementing the procedures in the classroom. The results of the primary research question support findings by Flynn and Lo (2016) that DRA procedures are effective in increasing the rate of an alternative behavior when implemented by a classroom teacher in a natural setting.

The current study also supported previous findings that teachers can be trained to implement trial-based FA procedures in the classroom with fidelity (Flynn & Lo, 2016; LeJeune et al., 2018). The total duration of the trial-based FA was 22 min and the teacher implemented procedures with 100% fidelity during the first independent role-play session with a graduate student. No pre-assessment data were collected prior to the training to examine how much growth may have occurred in the one training session. Although there are no FBA results to compare with the trial-based FA results, the trial-based FA results did not completely match the hypotheses created by the researcher based on interview and direct observation. This finding supports Campbell (2003) in noting the importance of conducting functional analyses to determine function prior to creating an intervention.

After an appropriate intervention was developed for each participant, the teacher was trained in the DRA procedures. Similar to the trial-based FA training, the training was short (28 min) and the teacher implemented the procedures for both participants with 100% fidelity on the first independent role-play session. A functional relation was

demonstrated for Fred, however, there was behavioral covariation and variability in Howard's data. Based on anecdotal data collection during sessions, the mands that Howard had been taught to verbalize or touch on his AAC overgeneralized to other conditions. For example, during the escape trials, he often would verbalize to request a book but did not request a break. Other anecdotal data revealed that during trials, Howard never used his AAC in isolation. He either verbalized the request or verbalized the request and used the AAC at the same time. Additionally, Howard's mean length utterance increased during trials based on anecdotal data. Based on teacher report and direct observation, the DRA procedures were written for Howard to verbalize, at minimum, a two-word utterance. In the beginning sessions, his verbalizations were between two to three utterances (e.g., "more iPad"), but in later sessions the request increased in length to seven or eight utterances (e.g., "Hey Ms. (teacher), I want the iPad please."). This increase in mean length utterance may be from hearing the teacher model the phrase but also hearing it when he engaged with the AAC. The teacher reported that outside of sessions his verbalizations also increased and bids for attention became more appropriate. The data revealed that Howard's latency to the target behavior did not return to initial baseline levels after the withdraw of the intervention. This may be explained by his increase in verbalizations. While he sometimes did not engage in alternative behavior, anecdotal data reveal that he was verbalizing a variety of things which may have been an attempt to engage in the alternative behavior. Increasing verbalizations was not measured systematically and future research should be conducted to distinctly measure this.

Prior to the study, the teacher restricted access to any three-dimensional box (e.g., a tissue box) in her classroom as an antecedent strategy to prevent Fred from destroying

the material. Based on unsolicited parent report to the teacher, boxes were also hidden in the home, specifically the kitchen, because Fred often destroyed those materials. During the first intervention condition, the teacher left the tissue box out with the visual used during sessions next to it. She reported on three occasions, Fred grabbed the tissue box then looked at the visual and made one of the following statements independently, “Crumpling the box is not a choice” or “The box is not a toy.” Also, during the first intervention condition, Fred’s parents reported that there had been a decrease in destroying different materials at home although a visual had not been sent home in an effort to generalize the behavior across settings. During the withdrawal of the intervention, the tissue box remained out in the classroom but the visual was not available and there were zero occurrences of Fred destroying it.

Limitations and Future Research

One limitation of this study was both participants were from the same classroom and procedures were implemented by the same teacher, who had received classes in ABA. The participants were both also diagnosed with ASD. Future research should train teachers that have limited exposure to the procedures and recruit an older population with different diagnoses.

Secondly, there were several medication changes for Howard throughout the study. The first medication change aligns with session 7, the first day in which the rate of the alternative behavior was low but also the latency to the target behavior was elevated. Also, Howard had a communication goal in his IEP that was similar to the goal of manding for attention, items, or a break. While the teacher reported little to no progress in the last two years, the history of being exposed to the phrases may account for the

variability in his data. The history of being taught to mand could also account for the behavioral covariation seen in the tangible condition.

The third limitation of the study was the limited number of DRA trials throughout the school day. Six trials were conducted consecutively each session and, while the teacher used similar procedures if the participant engaged in the alternative behavior outside of a session, the procedures were not identical. If more sessions had been embedded throughout each day, the schedule of reinforcement may have been able to be thinned at a quicker rate. Additionally, Howard was only exposed to two trials per function for each session so a change in data from 0% to 50% engagement in the alternative behavior was only an increase from zero occurrences to one occurrence. Future research should embed more trials throughout the school day to determine how quickly a schedule of reinforcement can be thinned as well as how thin a schedule of reinforcement can become with the intervention still being effective.

A fourth limitation relates to Howard's access to the AAC during baseline conditions in the DRA sessions. While the AAC was available to him, the communication app was not turned on and, therefore, increased the response effort required to make the request. During intervention sessions, the visual that served as the discriminative stimulus was located on the communication application and the response effort to engage in the alternative behavior was less. There were no instances of Howard using only the AAC to mand during sessions, he either verbalized the mand or verbalized the mand while simultaneously pressing the AAC.

Conclusion

In summary, the study supports previous findings that classroom teachers can be trained to implement trial-based FAs and DRAs with fidelity. The DRA procedures were effective for Fred and anecdotal data show that the alternative behavior generalized to new settings and across other materials. Fred's schedule of reinforcement started to be thinned, but due to time constraints, the schedule could only be thinned by one min for one session. Howard's data during the DRA was more variable, however, based on teacher report the alternative behavior generalized outside of sessions and his appropriate verbalizations increased during the study.

Appendix A Trial-based FA Data Sheet

Participant: Teacher:						Behaviors		
Date	Session	Condition	Therapist	Time Start	Time End	Scream	Aggression	PD
Behavior				Definition				
1								
Condition		EO/Antecedent				Consequence		
1								
2								
3								
4								

Appendix B

Trial-based FA Procedural Fidelity

Date:	PF Initials:	Session:
Start Time:	End Time:	

Procedural Fidelity		
Steps for Implementation - Attention	+ / - / NA	+ / - / NA
1. Control condition – 1 min (e.g., access to neutrally preferred item, attention being provided, no demands)		
2. Attention diverted		
3. Attention delivered contingent on target behavior		
4. Trial ends after 3 min. if no target behavior		
Total number of steps implemented: _____		
Procedural Fidelity % _____		

Procedural Fidelity		
Steps for Implementation - Escape	+ / - / NA	+ / - / NA
1. Control condition – 1 min (e.g., access to neutrally preferred item, attention being provided, no demands)		
2. Demand pressed		
3. Demand removed contingent on target behavior		
4. Trial ends after 3 min. if no target behavior		
Total number of steps implemented: _____		
Procedural Fidelity % _____		

Procedural Fidelity		
Steps for Implementation - Tangible	+ / - / NA	+ / - / NA
1. Control condition – 1 min (e.g., access to highly preferred item, attention being provided, no demands)		
2. Item removed		
3. Item returned contingent on target behavior		
4. Trial ends after 3 min. if no target behavior		
Total number of steps implemented: _____		
Procedural Fidelity % _____		

Total number of steps implemented: _____

Appendix C

DRA Data Sheet

Participant: Teacher:						Behaviors		
Date	Session	Condition	Therapist	Time Start	Time End			
Behavior			Definition					
1								
Condition			EO/Antecedent			Consequence		
1								
2								
3								
4								

Appendix D
DRA - Procedural Fidelity

Steps for Implementation - Baseline	+ / - / NA									
Trials	1	2	3	4	5	6	7	8	9	10
1. Control										
2. Arrange environment										
3. IF student engaged in target behavior - reinforced										
4. IF does not engage in target behavior, ends trial at 3 min.										

Trial-based FA Researcher Training Procedural Fidelity

Steps for Implementation - Intervention	+ / - / NA									
Trials	1	2	3	4	5	6	7	8	9	10
1. Control										
2. Arrange environment										
3. Wait for student response										
4. IF student engaged in alternative behavior - reinforced										
5. IF student engaged in target behavior - extinction procedures used and reprompt										
6. IF student did not respond – prompted to use alternative behavior										
7. Praise student for alternative behavior										
Total number of steps implemented: _____										
Procedural Fidelity % _____										

Appendix E
DRA - Procedural Fidelity

Steps for Implementation - Baseline	+ / - / NA									
Trials	1	2	3	4	5	6	7	8	9	10
5. Control										
6. Arrange environment										
7. IF student engaged in target behavior - reinforced										
8. IF does not engage in target behavior, ends trial at 3 min.										
9. Reinforce alternative behavior										
10. End										

Steps for Implementation - Intervention	+ / - / NA									
Trials	1	2	3	4	5	6	7	8	9	10
8. Control										
9. Arrange environment										
10. Wait for student response										
11. IF student engaged in alternative behavior - reinforced										
12. IF student engaged in target behavior - extinction procedures used and reprompt										
13. IF student did not respond – prompted to use alternative behavior										
14. Praise student for alternative behavior										
Total number of steps implemented: _____										
Procedural Fidelity % _____										

Appendix F
DRA IOA Data Sheet

Participant: Teacher:						Behaviors		
Date	Session	Condition	Therapist	Time Start	Time End	Scream	Aggression	PD
Behavior			Definition					
1								
Condition			EO/Antecedent				Consequence	
1								
2								
3								
4								

IOA % _____

Appendix G

Trial-based FA Researcher Training Procedural Fidelity

Procedural Fidelity	
Steps for Implementation	+ / -
1. Materials available (handout, PowerPoint)	
2. Rational for FA given	
3. Each condition explained	
4. Model	
5. Role play	
6. Instructional feedback given during role play	
7. Praise delivered	
8. Asked if there were any questions	
Procedural Fidelity _____%	

DRA Researcher Training Procedural Fidelity

Procedural Fidelity	
Steps for Implementation	+ / -
1. Materials available (handout, PowerPoint)	
2. Rational for DRA given	
3. Responses in each condition explained	
4. Model	
5. Role play	
6. Instructional feedback given during role play	
7. Praise delivered	
8. Asked if there were any questions	
Procedural Fidelity _____%	

Appendix H
Trial-based FA Procedural Fidelity

Date:	PF Initials:	Session:
Start Time:	End Time:	

Procedural Fidelity		
Steps for Implementation - Attention	+ / - / NA	+ / - / NA
5. Control condition – 1 min (e.g., access to neutrally preferred item, attention being provided, no demands)		
6. Attention diverted		
7. Attention delivered contingent on target behavior		
8. Trial ends after 3 min. if no target behavior		
Total number of steps implemented: _____ Procedural Fidelity % _____		

Procedural Fidelity		
Steps for Implementation - Escape	+ / - / NA	+ / - / NA
5. Control condition – 1 min (e.g., access to neutrally preferred item, attention being provided, no demands)		
6. Demand pressed		
7. Demand removed contingent on target behavior		
8. Trial ends after 3 min. if no target behavior		
Total number of steps implemented: _____ Procedural Fidelity % _____		

Procedural Fidelity		
Steps for Implementation - Tangible	+ / - / NA	+ / - / NA
5. Control condition – 1 min (e.g., access to highly preferred item, attention being provided, no demands)		
6. Item removed		
7. Item returned contingent on target behavior		
8. Trial ends after 3 min. if no target behavior		
Total number of steps implemented: _____ Procedural Fidelity % _____		

Total number of steps implemented: _____
Procedural Fidelity % _____

Appendix I
DRA Procedural Fidelity

Steps for Implementation - Baseline	+ / - / NA									
Trials	1	2	3	4	5	6	7	8	9	10
11. Control										
12. Arrange environment										
13. IF student engaged in target behavior - reinforced										
14. IF does not engage in target behavior, ends trial at 3 min.										
15. Reinforce alternative behavior										
16. End										

Steps for Implementation - Intervention	+ / - / NA									
Trials	1	2	3	4	5	6	7	8	9	10
15. Control										
16. Arrange environment										
17. Wait for student response										
18. IF student engaged in alternative behavior - reinforced										
19. IF student engaged in target behavior - extinction procedures used and reprompt										
20. IF student did not respond – prompted to use alternative behavior										
21. Praise student for alternative behavior										

Total number of steps implemented: _____
Procedural Fidelity % _____

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