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Effects of Intensity and Spacing of Problem Behavior on Levels of Treatment Integrity

by

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Abstract

Problem behavior can be extremely disruptive and can impact a person's success in his home, school, and community. A behavior intervention plan (BIP) can be developed to reduce the problem behavior and increase appropriate behavior. However, for BIPs to be successful, behavior-change agents must implement the procedures with high levels of integrity. The purpose of this study was to evaluate two variables (intensity of problem behavior and spacing of problem behavior) on levels of treatment integrity. Participants were assigned to a BIP that used differential reinforcement of alternative behavior (DRA) or differential reinforcement of other behavior (DRO), as well as a test condition (spacing or intensity). During the test condition, the intensity or the spacing of the problem behavior was manipulated so that 70% of instances were irregularly spaced or occurred with increased intensity. All participants engaged in similar levels of integrity during the control and the spacing or intensity condition. Participants who implemented the DRO protocol had overall lower levels of treatment integrity compared to participants who implemented the DRA protocol.

Keywords: treatment integrity, behavior intervention plan, staff training, behavior skills training

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Chapter 1: Literature Review

Autism spectrum disorder (ASD) affects individuals' ability to interact socially due to limitations in social skills, repetitive or restrictive behaviors, and difficulties in communication skills (American Psychological Association, 2013). Often, the difficulties in communication can result in challenging and problematic behaviors. Individuals with ASD who engage in high levels of problem behavior have greater social skills deficits than individuals who engage in low levels of problem behavior (Matson, Hess, & Mahan, 2013). Individuals may engage in problem behavior (e.g., aggression, self-injurious behavior, disruption) to gain access to preferred stimuli (e.g., a favorite snack or toy) or to remove aversive stimuli (e.g., instructions to do complete work, social interactions). In an educational setting, problem behavior can be disruptive to the learning of that individual and the other students in the class. The teacher may also remove the child from the classroom because of his or her behavior. The Individuals with Disabilities Education Improvement Act (IDEA; 2004) requires that if a child, specifically a child with an Individualized Education Plan (IEP), has to be removed from his current educational placement due to problem behavior that interferes with the learning of that student or other students, the individual should receive a functional behavior assessment and behavioral intervention services.

The purpose of a functional behavior assessment is to identify potential antecedent events that could evoke behavior and potential reinforcers that could be maintaining the behavior and to use that information to develop a behavior intervention

plan to reduce the problem behavior. The behavior intervention plan will be implemented in the classroom by teachers or paraprofessionals, and should be implemented across the individual's entire day or during the periods of the day associated with problem behavior. Although a behavior analyst develops the behavior intervention plans, due to limited resources, behavior analysts cannot provide care to one client throughout the entire day. Therefore, the behavior analyst must train caregivers, school personnel, and direct-care providers to implement the procedures used in the behavior intervention plan.

Differential reinforcement and noncontingent reinforcement schedules have been used in behavior intervention plans to reduce problem behavior (Drasgow, Yell, Bradley, & Shriner, 1999). Behavior intervention plans may include differential reinforcement procedures and antecedent manipulations to decrease problem behavior and increase appropriate behavior (Drasgow et al., 1999), including differential reinforcement of other behavior (DRO), differential reinforcement of alternative behavior (DRA), or time-based reinforcement (e.g., noncontingent reinforcement; fixed-time (FT) schedule). Behavior intervention plans frequently involve implementing extinction following the target behavior (i.e., the functional reinforcer is no longer delivered following the target behavior). For example, if an individual has attention-maintained aggression, the staff or teacher working with that individual would not provide attention following aggression. Extinction can be implemented to enhance the effectiveness of DRO, DRA, and time-based reinforcement procedures; however, reinforcement procedures can still be effective without extinction (Athens & Vollmer, 2010; Vollmer et al., 1993).

Differential Reinforcement of Other Behavior

Differential reinforcement of other behavior (DRO) procedures involve the delivery of the reinforcer contingent on the absence of the target behavior for a specified duration (Vollmer & Iwata, 1992). The initial interval duration could be determined based on responding during baseline (e.g., Cook, Rapp, & Schulze, 2015). The DRO schedule can be arranged based on the absence of the target behavior for the entire interval (whole interval DRO; Vollmer et al., 1993) or for a specific sampling interval (momentary DRO; Lindberg, Iwata, Kahng, & DeLeon, 1999). The DRO interval may be arranged as a fixed interval (the duration of the interval does not change; Vollmer et al., 1993) or a variable interval (the duration of the interval changes for each opportunity, but all intervals average to a set number; Lindberg et al., 1999). Finally, the behavior analyst programs the DRO interval to reset (resetting DRO) following an instance of target behavior, or to continue to elapse following problem behavior (nonresetting DRO). During a resetting DRO, the therapist stops and resets the interval duration following an occurrence of problem behavior (Vollmer et al., 1993). During a nonresetting DRO, the therapist allows the interval to elapse (i.e., the interval does not reset) following an instance of the behavior, refrains from delivering the reinforcer at the end of the interval, and begins a new interval (Repp, Barton, & Brulle, 1983).

Interventions using DRO have been successful at reducing problem behavior, including self-injurious behavior (Mazaleski, Iwata, Vollmer, Zarcone, & Smith, 1993; Vollmer et al., 1993), skin-picking (Tiger et al., 2009), disruptive behavior (Kodak, Miltenberger, & Romaniuk, 2003b), elopement (Call, Pabico, Findley, & Valentino, 2011), and stereotypy (Lanovaz & Argumedes, 2010), as well as increasing appropriate

behavior, such as wearing medical bracelets (Cook et al., 2015), tolerating haircutting (Schumacher & Rapp, 2011), and compliance (Kodak et al., 2003b). DRO interventions have been successful across functions of behavior, including attention-maintained behavior (Call et al., 2011; Kodak, Miltenberger, & Romaniuk, 2003a; Mazaleski et al., 1993), escape-maintained behavior (Kodak et al., 2003a), behavior maintained by access to tangibles (Call et al., 2011), and automatically maintained behavior (Lanovaz & Argumedes, 2010; Lustig et al., 2014).

Mazaleski and colleagues (1993) evaluated a resetting DRO with extinction and without extinction on levels of attention-maintained self-injurious behavior. During the DRO with extinction, the experimenter reset the interval following instances of self-injurious behavior and refrained from delivering attention. Following 15 s in the absence of self-injurious behavior, the participant gained access to an arbitrary reinforcer (highly preferred tangible item). During DRO without extinction, the therapist reset the DRO interval and delivered attention following self-injurious behavior. Overall, DRO was effective to reduce self-injurious behavior, but only when combined with extinction.

Kodak et al. (2003a) evaluated the effects of a resetting DRO on problem behavior (destruction and inappropriate vocalizations) maintained by escape and attention. Therapists provided functional reinforcers (i.e., break and attention) following 10 s in the absence of problem behavior. DRO was effective to reduce problem behavior and increase compliance, although there was not a direct contingency for compliance.

A behavior intervention plan using DRO can be effective in reducing problem behavior or increasing appropriate behavior. However, DRO requires the change agent to continuously monitor the client's behavior, which may be difficult for teachers or

caregivers (Vollmer et al., 1993). Additionally, a DRO intervention does not directly target an alternative, more appropriate way to gain access to the functional reinforcer (Vollmer et al., 1993).

Differential Reinforcement of Alternative Behavior (DRA)

A DRA intervention involves selecting one or more specific responses that are topographically different from the problem behavior, but are intended to replace the problem behavior with a more functional appropriate response. The appropriate target response may be most effective when functional reinforcers are delivered following the alternative response. If arbitrary (i.e., nonfunctional) reinforcers are delivered following the alternative response, therapists should use established reinforcers, such as edibles, tokens, or tangibles (Vollmer & Iwata, 1992). Interventions including DRA have been effective in reducing problem behavior, including aggression (Rispoli, Camargo, Machalicek, Lang, & Sigafoos, 2014; Vollmer, Roane, Ringdahl, & Marcus, 1999), self-injurious behavior (Vollmer et al., 1999), disruption (Athens & Vollmer, 2010; LeGray, Dufrene, Sterling-Turner, Olmmi, & Bellone, 2010), inappropriate vocalizations (Franco et al., 2009; Petscher & Bailey, 2008), crying and screaming (Rispoli et al., 2014), and work refusal (Petscher & Bailey, 2008). DRA interventions are effective across different functions of behavior, including behavior maintained by attention (Athens & Vollmer, 2010; LeGray et al., 2010), escape from demands (Athens & Vollmer, 2010; Franco et al., 2009; Vollmer et al., 1999), access to tangibles (Athens & Vollmer, 2010; Franco et al., 2009; LeGray et al., 2010; Vollmer et al., 1999), and access to rituals (Rispoli et al., 2014).

The DRA intervention can include targeting a response already in the learner's repertoire (e.g., compliance with demands, exchanging a picture, or touching a card) or teaching a new alternative response. For example, if teaching an alternative response with an individual with escape-maintained aggression, the therapist could train a break request (e.g., vocally stating "break," touching a break card, or signing for a break). Following a break request, the therapist removes demands for a brief duration (e.g., 30 s). Following aggression, a break is not provided.

Athens and Vollmer (2010) targeted problem behavior by functionally matching the consequences (i.e., the alternative behavior produced access to the maintaining reinforcer), but without extinction for the target behavior (i.e., the functional reinforcer was still provided following the target behavior). DRA without extinction is most likely to be effective when the reinforcement schedule, magnitude, or quality favors the alternative behavior over inappropriate behavior (i.e., the reinforcement schedule, reinforcer magnitude, or quality of the reinforcer for the appropriate behavior should be greater than the reinforcer for inappropriate behavior).

Rispoli and colleagues (2014) used functional communication training (FCT) with extinction to reduce problem behavior maintained by access to rituals. The functional communicative response was "I don't want that" or the exchange of a picture card. Contingent on the exchange of the picture card or saying "I don't want that," the therapist provided access to engage in their specific rituals for 30 s. FCT was effective in reducing problem behavior to low levels and increasing the functional communicative response.

An intervention involving DRA is desirable because reinforcing a specific alternative response with the functional reinforcer can reduce the side effects of

extinction (Lerman & Iwata, 1996). In addition, DRA may teach a new, socially appropriate response that allows the individual to gain access to the functional reinforcer in the natural environment (e.g., teaches the individual to ask for attention). However, the individuals in the natural environment may not always reinforce the alternative response (Petscher, Rey, & Bailey, 2009). For example, if the child's mother is on the phone, she may ignore requests for attention or ask the child to wait.

Time-Based Reinforcement

Time-based reinforcement (also referred to as noncontingent reinforcement (NCR) in the applied literature) involves the response-independent delivery of reinforcing stimuli (Vollmer et al., 1993). Instead of delivering reinforcers contingent on a response, the therapist delivers the reinforcer based on the passage of time (i.e., on a time-based schedule). Time-based reinforcement is designed to terminate the relation between the target problem behavior and the functional reinforcer by delivering the reinforcer regardless of the occurrence of the target behavior. This should decrease the motivation to engage in the target behavior to gain access to the functional reinforcer (Carr, Severtson, & Lepper, 2009). Reinforcers can be available continuously (e.g., an individual always has access to a preferred tangible), delivered on a fixed-time interval (e.g., the therapist delivers a 2-min break every 15 min), or delivered on a variable-time interval (e.g., the therapist delivers a preferred edible, on average, every 20 s, with the intervals ranging between 5 s and 35 s). The occurrence of problem behavior does not affect when the reinforcer is delivered.

Because reinforcer delivery is based on the passage of time, it is possible that the delivery of the reinforcer in close temporal relation to the target behavior results in

adventitious reinforcement. To address the possibility of adventitious reinforcement, therapists can use one of two procedural variations. One variation is a time-delay procedure, during which the reinforcer delivery is delayed by a specified duration if the target behavior occurs at the time of a scheduled reinforcer delivery (Piazza, Hanley, & Fisher, 1996). The other variation is an omission criterion, during which the therapist would omit the delivery of the reinforcer for that interval if the target behavior occurred at the same time as a scheduled reinforcer delivery (Vollmer, Ringdahl, Roane, & Marcus, 1997).

Time-based reinforcement procedures have been used to reduce problem behavior, including self-injurious behavior (van Camp et al., 2000; Vollmer et al., 1993; Vollmer, Marcus, & Ringdahl, 1995), aggression (Kodak et al., 2003a), vocal stereotypy (Enloe & Rapp, 2014), food refusal (Wilder, Normand, & Atwell, 2005), and rumination (Wilder, Register, Register, Bajagic, & Neidert, 2009), as well as increase appropriate behavior, such as compliance with wearing prostheses (Richling et al., 2011). Time-based reinforcement has been effective in reducing behavior maintained by attention (Kodak et al., 2003a; Vollmer et al., 1993; Wallace, Iwata, Hanley, Thompson, & Roscoe, 2012), escape from demands (Kodak et al., 2003a; Vollmer et al., 1995; Wider et al., 2005), access to tangibles (van Camp et al., 2000), and automatic reinforcement (Enloe & Rapp, 2014; Wilder et al., 2009).

Wilder and colleagues (2009) delivered a flavored spray on an FT 20-s schedule for 10 min following meal consumption to address rumination maintained by automatic reinforcement. The FT delivery of fruit spray was effective in reducing rumination. Kodak and colleagues (2003a) evaluated NCR on problem behavior maintained by

attention and escape. Every 10 s, the therapist provided a 50-s break from work with attention during the break. After the break, the therapist began the 10-s timer again. The FT break delivery was effective in reducing problem behavior.

Time-based reinforcement procedures do not require continuous observation of the client's behavior and may be more practical for teachers and caregivers (Vollmer et al., 1993). Additionally, the learner can contact high rates of reinforcement with time-based procedures. However, time-based procedures may result in the adventitious reinforcement of the target behavior (van Camp, Lerman, Kelley, Contrucci, & Vorndren, 2000) by potentially reinforcing behavior during an extinction burst (i.e., the increase in frequency of a behavior following the discontinuation of reinforcer delivery). Additionally, time-based reinforcement procedures may impede with acquisition of other appropriate behavior. Goh, Iwata, and DeLeon (2000) showed that an alternative response (i.e., mands) did not occur at high rates when time-based reinforcement with dense schedules of reinforcement were in place. However, the rate of mands increased as the reinforcement schedule was thinned. A final potential disadvantage to time-based reinforcement is that parents may prefer contingent reinforcement over response-independent reinforcement (Gabor, Fritz, Roath, Rothe, & Gourley, 2016). For example, Gabor and colleagues (2016) evaluated parent preferences for interventions and found that parents chose to implement interventions with contingent reinforcement components rather than interventions with time-based reinforcement.

Training Others to Implement Behavior Reduction Procedures

Behavior Skills Training (BST)

There is a well-established literature to show that behavior skills training (BST) is effective to train others to implement behavioral interventions with high levels of integrity, including parents (Crone & Shukla Mehta, 2016; Harriage, Cho Blair, & Miltenberger, 2016; Miles & Wilder, 2009; Shayne & Miltenberger, 2013), instructional staff (Hogan, Knez, & Kahng, 2015; Nigro-Bruzzi & Sturmey, 2010; Sarokoff & Sturmey, 2004), teachers (Ward-Horner & Sturmey, 2012), and undergraduates (Rosales, Stone, & Rehfeldt, 2009). Training using BST includes four main components: instructions, modeling, role plays to practice the procedures, and feedback from the trainer (Ward-Horner & Sturmey, 2012). BST has been used to teach a range of skills, including discrete-trial training (Lafasakis & Sturmey, 2007; Sarokoff & Sturmey, 2004), functional assessments (Shayne & Miltenberger, 2013), safety skills (Harriage et al., 2016; Johnson et al., 2005), teaching staff to conduct mand training (Nigro-Bruzzi & Sturmey, 2010), implementing meal programs (Seiverling, Williams, Sturmey, & Hart, 2012), guided compliance (Miles & Wilder, 2009), and implementation of picture exchange communication system (PECS; Rosales et al., 2009).

Behavior skills training is effective to train reinforcement procedures, including DRO, DRA, and time-based reinforcement. Flynn and Lo (2016) used a BST package to train teachers to implement DRA procedures. The target alternative behavior was a functionally equivalent response to the problem behavior (e.g., raising hand to get attention, asking for a break to escape demands) that was individualized for each participant. The training was conducted with a confederate until the trainees implemented

the procedures with 100% integrity. Following the training, trainees implemented the DRA procedure with one student in their classroom. Two of three trainees maintained high levels of treatment integrity when implementing DRA with a second student. Hogan, Knew, and Kahng (2015) successfully used BST to train staff to implement behavior plans that included DRA (e.g., tokens delivered for compliance), NCR, and extinction components. Finally, Gabor and colleagues (2016) used BST to train parents to implement DRO (the interval for each child was based on the baseline interresponse times), DRA (a specific response selected by the parents), and time-based reinforcement schedules (the interval for each child was based on the baseline interresponse times). Overall, BST is an effective procedure to train reinforcement procedures to high levels of treatment integrity.

Treatment Integrity

Treatment integrity is the degree to which a behavioral protocol is implemented as prescribed (DiGennaro, Martens, & Kleinmann, 2007; DiGennaro Reed, Reed, Baez, & Maguire, 2011). There are two main types of treatment integrity errors: omission errors and commission errors. Omission errors involve the failure to implement prescribed treatment components. For example, an omission error would include the failure to deliver a reinforcer following appropriate behavior. Commission errors involve the addition of stimuli that are not outlined in the protocols. For example, a commission error would include delivering the reinforcer following inappropriate behavior when the protocol outlines extinction for inappropriate behavior.

Levels of treatment integrity are negatively correlated with levels of problem behavior (DiGenarro et al., 2007), meaning that reduced levels of treatment integrity can

be detrimental to treatment outcomes, causing increases in inappropriate behavior (Leon, Wilder, Majdalany, Myers, & Saini, 2014; St. Peter Pipkin, Vollmer, & Sloman, 2010; Vollmer, Roane, Ringdahl, & Marcus, 1999). Vollmer and colleagues (1999) evaluated treatment challenges during DRA procedures. Although they did not evaluate sequence effects or separate the effects of omission and commission errors, Vollmer and colleagues (1999) generally found that if the reinforcement schedule favored the inappropriate behavior (i.e., the inappropriate behavior was more likely to be reinforced), levels of the inappropriate behavior would remain high.

St. Peter Pipkin et al. (2010) evaluated the effects of omission errors, commission errors, and sequence effects on reductions of a target response during DRA interventions using a translational arrangement during which college students earned points based on key presses. One key was designated as an appropriate key, and another key was designated as an inappropriate key. This arrangement was designed to resemble appropriate and inappropriate behavior. They evaluated the failure to deliver a reinforcer following an appropriate key press (i.e., omission error) and the delivery of the reinforcer following the inappropriate key press (i.e., commission error). The experimenters used a parametric analysis to systematically evaluate the effects of different levels of treatment integrity on inappropriate and appropriate behavior. Generally, as levels of treatment integrity declined, the appropriate behavior decreased and inappropriate behavior increased. Treatment integrity errors made early in treatment were more detrimental to reductions in the inappropriate behavior (i.e., these errors increased rates of inappropriate behavior to higher levels) than errors that occurred later in treatment. Specifically, following baseline, treatment implemented with low levels of treatment integrity (i.e.,

20% and 40% correct integrity) did not result in reductions in the inappropriate behavior. However, low levels of treatment integrity following high levels of integrity (i.e., 80% and 100%) produced less of a decrease in appropriate behavior and less of an increase in inappropriate behavior. These effects from the translational arrangement were replicated in an applied setting with a client who engaged in off-task behavior.

Leon and colleagues (2014) evaluated an error of omission by failing to deliver an edible for compliance and an error of commission by delivering an edible following noncompliance. The results replicated St. Peter Pipkin et al. (2010) in that errors of commission were most detrimental to treatment outcomes (i.e., errors of commission maintained higher levels of the problem behavior than omission errors), and the impact of the omission errors depended on which conditions preceded the errors (e.g., high vs. low levels of integrity). When higher levels of treatment integrity preceded lower levels early in treatment, the problem behavior remained lower than when lower levels of treatment integrity preceded higher levels of treatment integrity.

Given that high levels of treatment integrity are required early in treatment to produce the best treatment effects, caregivers and staff may need to be heavily monitored in the initial stages of treatment to ensure high levels of integrity in the natural environment. However, the variables that may influence levels of treatment integrity in the natural environment are relatively unknown. Once the variables that affect treatment integrity are identified, this can inform training practices to ensure that staff implementing behavior plans are well trained and that the desired treatment effects are observed. Although Hogan and colleagues (2015) suggest that behavior that occurs at a higher level of intensity or in close temporal proximity may increase the difficulty of

implementation (i.e., there are more integrity errors associated with these conditions), little research has directly evaluated the effects of these variables on levels of treatment integrity.

Variables that affect levels of treatment integrity. Differential reinforcement procedures are commonly combined with extinction (Petscher et al., 2009). When a new intervention that includes extinction is initially implemented, the client may engage in problem behavior at a greater magnitude, with more variable topographies, including aggression or emotional responding (e.g., crying, tantrums), or at higher rates or greater durations (Lerman & Iwata, 1996). These new and variable responses may be different than the behavior the change agents were originally trained to implement the procedures with. For example, in a training situation, the trainer is unlikely to engage in aggression in a role play that is targeted towards the trainee's face or at a level that could cause injury. However, in the natural environment, a client could engage in head-directed aggression or engage in aggression at a level that could cause injury.

Decreased levels of treatment integrity impact not only behavior reduction procedures, but also have detrimental effects on skill acquisition. DiGennaro Reed and colleagues (2011) systematically evaluated levels of treatment integrity during error-correction procedures on skill acquisition. Both the 0% and 50% integrity conditions resulted in low levels of correct responses, while the 100% integrity condition resulted in high levels of correct responses. Carroll, Kodak, and Fisher (2013) collected data on the different types of treatment-integrity errors that occurred during the implementation of discrete-trial instruction in the natural environment. The authors identified that the most common errors were failing to deliver contingent reinforcers following correct responses,

failing to deliver the correct prompt, and presenting the instruction more than once. Practitioners may use these findings when training to provide additional instruction or emphasis on these components. Currently, the types of errors that are most commonly made during the implementation of behavior intervention plans in the natural environment are relatively unknown. However, Pence, St. Peter, and Giles (2014) evaluated the types of errors commonly made during implementation of functional analysis conditions. Teachers were most likely to make errors arranging the antecedents and providing the appropriate consequences during the escape condition and providing the appropriate consequences during the attention condition.

Neef (1995) suggested that skills learned during BST may not generalize to the natural environment with high levels of treatment integrity. However, there are several studies that show that generalization can occur from simulated training settings to the natural environment with high levels of integrity (e.g., Pence et al., 2014; Pence, St. Peter, & Tetreault, 2012). Hogan and colleagues (2015) speculated that trainees may fail to generalize skills of implementing behavior intervention plans with high levels of integrity to naturalistic settings because student's behavior is less predictable when compared to the trainer's behavior. Hogan et al. used BST to teach instructional staff to implement behavior intervention plans that contained DRA, extinction, and time-based reinforcement components with students in a nonpublic day school. Instructional staff implemented the behavior intervention plans with high levels of treatment integrity following BST. Although Hogan et al. did not directly collect data on student performance, they recommended that future studies directly evaluate if the student's behavior can influence staff performance on the implementation of BIPs. Ideally, staff

could be trained in an analogue setting to maintain high levels of integrity during variable and unpredictable behavior, increasing the likelihood of a successful intervention.

Chapter 2: Experimental Procedures

Literature Review

There is a well-established literature to show that behavior skills training (BST) is effective to train others to implement behavioral interventions with high levels of integrity, including parents (Crone & Shukla Mehta, 2016; Harriage, Cho Blair, & Miltenberger, 2016; Miles & Wilder, 2009; Shayne & Miltenberger, 2013), instructional staff (Hogan, Knez, & Kahng, 2015; Nigro-Bruzzi & Sturmey, 2010; Sarokoff & Sturmey, 2004), teachers (Ward-Horner & Sturmey, 2012), and undergraduates (Rosales, Stone, & Rehfeldt, 2009). Training using BST includes four main components: instructions, modeling, role plays to practice the procedures, and feedback from the trainer (Ward-Horner & Sturmey, 2012). Behavior skills training has been used to teach a range of skills, including discrete-trial training (Lafasakis & Sturmey, 2007; Sarokoff & Sturmey, 2004), functional assessments (Shayne & Miltenberger, 2013), safety skills (Harriage et al., 2016; Johnson et al., 2005), teaching staff to conduct mand training (Nigro-Bruzzi & Sturmey, 2010), implementing meal programs (Seiverling, Williams, Sturmey, & Hart, 2012), guided compliance (Miles & Wilder, 2009), and implementation of picture exchange communication system (PECS; Rosales et al., 2009).

Behavior skills training is effective to train reinforcement procedures, including differential reinforcement of other behavior (DRO) and differential reinforcement of alternative behavior (DRA). For example, Flynn and Lo (2016) used a BST package to train teachers to implement DRA procedures. The target alternative behavior was a functionally equivalent response to the problem behavior (e.g., raising hand to get

attention, asking for a break to escape demands) that was individualized for each participant. The training was conducted with a confederate until the trainees implemented the procedures with 100% integrity. Following the training, trainees implemented the DRA procedure with one student in their classroom. Two of three trainees maintained high levels of treatment integrity when implementing DRA with a second student. Hogan, Knew, and Kahng (2015) successfully used BST to train staff to implement behavior plans that included DRA (e.g., tokens delivered for compliance) and extinction (e.g., refraining from commenting on behavior, does not allow escape or access to items) components. Finally, Gabor and colleagues (2016) used BST to train parents to implement DRO and DRA interventions with their children. Overall, BST is an effective procedure to train reinforcement procedures to high levels of treatment integrity.

Treatment integrity is the degree to which a behavioral protocol is implemented as prescribed (DiGennaro, Martens, & Kleinmann, 2007; DiGennaro Reed, Reed, Baez, & Maguire, 2011). There are two main types of treatment integrity errors: omission errors and commission errors. Omission errors involve the failure to implement prescribed treatment components. For example, an omission error would include the failure to deliver a reinforcer following appropriate behavior. Commission errors involve the addition of stimuli that are not outlined in the protocols. For example, a commission error would include delivering the reinforcer following inappropriate behavior when the protocol outlines extinction for inappropriate behavior.

Levels of treatment integrity are negatively correlated with levels of problem behavior (DiGenarro et al., 2007), meaning that reduced levels of treatment integrity can be detrimental to treatment outcomes, causing increases in inappropriate behavior (Leon,

Wilder, Majdalany, Myers, & Saini, 2014; St. Peter Pipkin, Vollmer, & Sloman, 2010; Vollmer, Roane, Ringdahl, & Marcus, 1999). Vollmer and colleagues (1999) evaluated treatment challenges during DRA procedures. Although they did not evaluate sequence effects or separate the effects of omission and commission errors, Vollmer and colleagues generally found that if the reinforcement schedule favored the inappropriate behavior (i.e., the inappropriate behavior was more likely to be reinforced), levels of the inappropriate behavior would remain high.

St. Peter Pipkin et al. (2010) evaluated the effects of omission errors, commission errors, and sequence effects on reductions of a target response during DRA interventions using a translational arrangement during which college students earned points based on key presses. One key was designated as an appropriate key (analog to the appropriate behavior), and another key was designated as an inappropriate key (analog to problem behavior). They evaluated the failure to deliver a reinforcer following an appropriate key press (i.e., omission error) and the delivery of the reinforcer following the inappropriate key press (i.e., commission error). The experimenters used a parametric analysis to systematically evaluate the effects of different levels of treatment integrity on inappropriate and appropriate behavior. Generally, as levels of treatment integrity declined, the appropriate behavior decreased and inappropriate behavior increased. Treatment integrity errors made early in treatment were more detrimental to reductions in the inappropriate behavior (i.e., these errors made rates of the inappropriate behavior increase more) than errors that occurred later in treatment. Specifically, following baseline, treatment implemented with low levels of treatment integrity (i.e., 20% and 40% correct integrity) did not result in reductions in the inappropriate behavior.

However, low levels of treatment integrity following high levels of integrity (i.e., 80% and 100%) produced less of a decrease in appropriate behavior and less of an increase in inappropriate behavior. These effects from the translational arrangement were replicated in an applied setting with a client who engaged in off-task behavior.

Leon and colleagues (2014) evaluated errors of omission by failing to deliver an edible for compliance and errors of commission by delivering an edible following noncompliance. The results replicated St. Peter Pipkin et al. (2010) in that errors of commission were most detrimental to treatment outcomes (i.e., errors of commission maintained higher levels of the problem behavior than omission errors), and the impact of the omission errors depended on which conditions preceded the errors (e.g., high vs. low levels of integrity). When higher levels of treatment integrity preceded lower levels of treatment integrity early in treatment, the problem behavior remained lower than when lower levels of treatment integrity preceded higher levels of treatment integrity.

Given that high levels of treatment integrity are required early in treatment to produce the best treatment effects, caregivers and staff may need to be heavily monitored in the initial stages of treatment to ensure high levels of integrity in the natural environment. However, the variables that may influence levels of treatment integrity in the natural environment are relatively unknown. Once the variables that affect treatment integrity are identified, this can inform training practices to ensure that staff implementing behavior plans are well trained and that the desired treatment effects are observed. Although Hogan and colleagues (2015) suggest that behavior that occurs at a higher level of intensity or in close temporal proximity may increase the difficulty of implementation (i.e., there are more integrity errors associated with these conditions),

little research has directly evaluated the effects of these variables on levels of treatment integrity.

Differential reinforcement procedures are commonly combined with extinction (Petscher et al., 2009). When a new intervention that includes extinction is initially implemented, the client may engage in problem behavior at a greater magnitude, with more variable topographies, including aggression or emotional responding (e.g., crying, tantrums), or at greater rates or durations (Lerman & Iwata, 1996). These new and variable responses may be different than the behavior the change agents were originally trained to implement the procedures with. For example, in a training situation, the trainer is unlikely to engage in aggression in a role play that is targeted towards the trainee's face or at a level that could cause injury. However, in the natural environment, a client could engage in head-directed aggression or engage in aggression at a level that could cause injury.

Currently, the types of errors that are most commonly made during the implementation of behavior intervention plans in the natural environment are relatively unknown. However, Pence, St. Peter, and Giles (2014) evaluated the types of errors commonly made during implementation of functional analysis conditions. Teachers were most likely to make errors arranging the antecedents and providing the appropriate consequences during the escape condition and providing the appropriate consequences during the attention condition.

Neef (1995) suggested that skills learned during BST may not generalize to the natural environment with high levels of treatment integrity. However, there are several studies that show that generalization can occur from simulated training settings to the

natural environment with high levels of integrity (Pence et al., 2014; Pence, St. Peter, & Tetreault, 2012). Hogan and colleagues (2015) speculated that trainees may fail to generalize skills of implementing behavior intervention plans with high levels of integrity to naturalistic settings because student's behavior is less predictable when compared to the trainer's behavior. Hogan et al. used BST to teach instructional staff to implement behavior intervention plans that contained DRA and extinction components with students in a nonpublic day school. Instructional staff implemented the behavior intervention plans with high levels of treatment integrity following BST. Although Hogan et al. did not directly collect data on student performance, they recommended that future studies should directly evaluate if the student's behavior can influence staff performance on the implementation of BIPs. Vollmer, Sloman, and St. Peter Pipkin (2008) suggested that the complexity of the protocol may influence levels of treatment integrity, or that decreased levels of treatment integrity could be a failure to generalize from the training environment to the natural environment. Ideally, staff could be trained in an analogue setting to maintain high levels of integrity during variable and unpredictable behavior, increasing the likelihood of a successful intervention.

In summary, although previous research indicates high levels of treatment integrity leads to more consistent and immediate reductions in problem behavior and more immediate increases in appropriate behavior, more research is needed on the variables that may influence levels of treatment integrity. Therefore, the purpose of this study is to compare treatment integrity levels under "standard training" conditions, under conditions with an increased intensity of behavior, and under conditions with bursts of behavior within an analogue setting with a confederate to simulate a client.

Method

Participants and Setting

Participants were six undergraduate students and one graduate student at a large public University in the Southeastern United States. Participants were between 19 and 25 years of age. Table 1 displays the demographic information, condition assignment, and compensation type for each participant. Participants were recruited through a university online system for psychology research participation and through flyers distributed in person and via email to individuals enrolled in psychology courses. Participants were excluded from the study if they had any physical impairments that would have impeded their ability to participate (e.g., visual or hearing impairments, physical mobility impairments). Participants received either monetary compensation or extra course credit. The experimenter scheduled a 120-min appointment for interested participants to come into a therapy room on the university campus where they participated in the study.

When participants arrived for the study, the experimenter oriented him or her to the room where the trainings were conducted. The room (2.5 m x 2.5 m) had a table, two chairs, and a one-way mirror. The room contained materials (e.g., work materials, edible reinforcers, pencils) needed to conduct the training. The experimenter introduced herself and described what participation in the study would entail.

The experimenter obtained informed consent from the participant. Participants were told that the purpose of this study was to evaluate how to train individuals on behavior-analytic procedures, and that the participants would be trained on a procedure and asked to implement it with an individual who engages in problem behavior similar to problem behavior exhibited by individuals with autism spectrum disorder and developmental disabilities. The experimenter indicated that the participant had the ability

to withdraw from the study at any point without penalty. After the participant's questions had been answered, the experimenter asked the participant to sign the informed consent document.

Data Collection and Interobserver Agreement

The confederates engaged in simulated target behavior during the training sessions. Target behavior included self-injurious behavior and disruption. Self-injurious behavior was defined as any instance a person makes contact with his or her own body with an open or closed hand from a distance of at least 15 cm (excluding clapping); any instance of a person's head making contact with a surface from 15 cm or greater; any instance of a person biting (closing teeth around) any part of her own body. Disruption was defined as any instance of a person throwing an object that travels a distance greater than 30 cm (excluding balls); any instance of swiping objects off a surface; any instance of ripping or tearing items; any instance of a person turning over furniture from its upright position; any instance of making contact with hands or feet to a surface (e.g., hitting or kicking walls, furniture) from a distance of 15 cm or greater.

The experimenter collected data on the correct and incorrect implementation for each procedure component using a treatment integrity data sheet. The data sheets are outlined in Appendix A (DRA) and Appendix B (DRO). The experimenter placed a tally under the correct or incorrect column depending on the participant's performance after each opportunity to perform a component of the protocol. The dependent measure was the percentage of correct responses, which was calculated by dividing the sum of correct responses by the total number of opportunities to respond and then multiplying by 100%.

Interobserver agreement (IOA) was collected by a secondary, independent observer for 37.5% of sessions. IOA was calculated by using proportional IOA for each component (Pence et al., 2014). Proportional IOA was calculated by dividing the smaller number by the larger number for each component (i.e., Observer 1 scores 4 instances of correct implementation for one component, and Observer 2 scores 3 instances, the proportion will be calculated by dividing 3 by 4). Correct and incorrect proportions were calculated separately. The proportions were added and divided by the total number of components (the correct and incorrect columns for each component each counted as one when adding the total number of components). The overall IOA across all participants was M = 81.2% (range, 72% to 95%).

Experimental Design

The effects of spacing and intensity of problem behavior on the levels of treatment integrity was evaluated using a multielement design. Participants were randomly assigned to a reinforcement procedure (i.e., DRA or DRO) and to a behavior manipulation condition (i.e., increased magnitude or irregular spacing). Conditions (control and manipulation) alternated in a quasi-random pattern. The conditions included a comparison between the 70% condition for the assigned manipulation (explained in more details below) and the control condition. The experimenter conducted five sessions of each condition with each participant. The progression through the study is outlined in Appendix C.

Confederate Training

Confederates were two graduate students studying Applied Behavior Analysis. Confederates were trained prior to the study using BST (i.e., instructions, modeling, role

plays, and feedback). The role plays and feedback for the confederates required the confederate to practice responding to the cues that were delivered by an audio recording through headphones attached to the confederate's cellular device. Confederates received feedback on how well they followed the script. Confederates were considered trained when they correctly completed 10 consecutive trials of following the cues delivered by the experimenter. The trial was scored as correct if the confederate engaged in the specified behavior within 1 s of the cue from the experimenter.

Behavior Skills Training

The experimenter trained the participant to implement the reinforcement procedure using BST. During the instruction portion of the training, the experimenter read a script (Appendix D) specific to the assigned reinforcement procedure. The script included a description of the reinforcement procedure and explanation of how to implement the procedure. The experimenter provided the participant with a copy of a behavior plan for the assigned reinforcement procedure. The participant had 10 min to review the plan, and then the experimenter answered any questions.

The confederate assisted the experimenter while modeling the reinforcement procedure. The confederate did not follow a script during the modeling sessions. The experimenter modeled and described each part of the behavior plan with the confederate. The experimenter provided the participant with the opportunity to ask questions and answered any questions. Then, the participant practiced each skill with the confederate until he or she demonstrated the skill correctly across three consecutive opportunities.

Following correct implementation during the role plays, the participant was required to implement the reinforcement procedure with the confederate during a 3-min

session. The experimenter gave the participant the following instructions: “Now it is your turn to practice. I will go into the observation room, and you will practice implementing the behavior plan, and [confederate’s name] will be your client. You will implement the procedures for 5 min. The time will start when I knock on the observation window. Do you have any questions?” The experimenter collected data on the components of the behavior plan that were implemented correctly and incorrectly. Following the completion of the session, the experimenter gave the participant feedback that consisted of positive feedback (i.e., praise for the components the participant implemented correctly) and corrective feedback (i.e., outlines errors and how to improve on components the participant implemented incorrectly).

The experimenter repeated the practice sessions and feedback until the participant performed the procedures with 90% accuracy across two consecutive sessions. Once the participant met mastery, the participant proceeded to the experiment he or she was assigned to. If a participant did not master the reinforcement procedures within 10 training sessions, the participant would have been dismissed from the study; however, this never occurred.

Procedures

General session procedures. Sessions were 5 min in duration. The experimenter stated, “I am going to go into the observation room, and I will knock on the window when the session is beginning.” During each session, the confederate engaged in 10 instances of problem behavior and five instances of independent compliance with demands. The confederate wore a pair of earbuds that were connected to a cellular

device. A script played during each session that communicated when and what topography of behavior to engage in (an example of a script is shown in Appendix E).

Control. During the control condition, the confederate engaged in behavior at moderate intensity and a single instance occurred at regular intervals. Moderate intensity included topographies of behavior such as body-targeted self-injurious behavior (excluding biting) and throwing, swiping, or ripping work materials. One instance of behavior was emitted approximately 30 s following the previous instance (inter-response time (IRT) was a range of 20 s to 40 s).

Increased intensity. During the increased intensity condition, the confederate engaged in behavior at a higher intensity for 7 of the 10 instances of behavior. High-intensity topographies included head-targeted self-injurious behavior, self-biting, turning over furniture, contact between surfaces from a distance of 0.6 m or greater, and ripping his/her own clothing.

Irregular spacing. All topographies of behavior in the irregular spacing condition were at moderate intensity (topographies described above). During this condition, 70% of the responses had an IRT that was within 5 s of the previous response.

Social validity questionnaire. After the participant completed all experimental sessions, the experimenter informed the participant that he or she had completed his or her participation in the study. The experimenter asked the participant to fill out a questionnaire regarding the participation in the study. The questions included in the survey are listed in Appendix F. The participant was asked to rank each statement on a 5-point Likert scale (1- strongly disagree to 5-strongly agree). The experimenter informed the participant that the responses will be kept confidential and that he or she should not

include any identifying information on the form. The experimenter instructed the participant to place the completed survey into a sealed manila envelope, and that the responses would not be evaluated until all participants had completed the experiment.

Debriefing. At the end of the study, the experimenter completed a debriefing with the participants on the purpose of the experiment. The experimenter followed a debriefing script (Appendix G). During the reading of the script, participants were assured that the confederates were graduate research assistants or trained behavior analysts, and the confederates did not harm themselves or the property in the room during the process of the experiment. The experimenter advised participants not to use these procedures without the supervision of a trained professional. The experimenter told participants that the purpose of the experiment was to evaluate how well he or she did implementing the procedures when high-intensity behavior occurred or when behavior was irregularly spaced. Following the conclusion of the reading of the script, the experimenter gave the participant an opportunity to ask questions. After the experimenter answered any questions, the participant was asked to sign a debriefing form and was given some psychological resources available (Appendix H). This form included phone numbers and addresses for on-campus psychological services and the local hospital.

Results

Spacing

Figure 1 shows the results for the spacing manipulation during DRA. P01 (top panel) engaged in high levels of treatment integrity during the control condition (M = 95.6%). During the spacing manipulation, levels of treatment integrity remained at high levels (M = 92.2%) that were slightly differentially lower than the control condition. P02

(bottom panel) engaged in high, undifferentiated levels of treatment integrity across the control (*M* = 97.9%) and the spacing (*M* = 96.6%) conditions.

The results for the spacing manipulation during DRO are depicted in Figure 2. P03 (top panel) engaged in similar levels of treatment integrity during the control (*M* = 93.9%) and spacing (*M* = 94.6%) conditions. P04 (bottom panel) had higher levels of treatment integrity in the spacing condition (*M* = 96%) than in the control condition (*M* = 92.1%).

Intensity

Figure 3 shows the results for the intensity manipulation during DRA. Levels of treatment integrity were high during the control condition (*M* = 99.1%) for P04 (top panel). During the intensity manipulation, levels of treatment integrity remained at high levels (*M* = 98.7%). P05 (bottom panel) engaged in high, undifferentiated levels of treatment integrity across the control (*M* = 100%) and intensity (*M* = 99.3%) conditions.

The results for the intensity manipulation during DRO are depicted in Figure 4. P06 (top panel) engaged in high levels of treatment integrity during both conditions, but the levels of treatment integrity were slightly lower during the intensity condition (*M* = 94%) than in the control condition (*M* = 97.1%). P07 (bottom panel) engaged in moderate to high levels of treatment integrity across the control (*M* = 84.7%) and intensity (*M* = 85.6%) conditions.

Social Validity

Results of the social validity survey are depicted in Table 2. Most participants rated the reinforcement procedures and the training to be socially valid by reporting that the procedure was easy to implement (*M* = 4.5) and that he or she believed that the

procedure would work to reduce problem behavior in schools (M = 4.75). Most participants reported that he or she felt comfortable implementing the plan again in the future (M = 4.5). Two participants rated the problem behavior as difficult to handle (M = 2.5). One participant commented that initially the procedures were difficult to implement, but the intervention got easier with practice. One participant in the intensity condition commented to the confederate between sessions stating, "Wow, you were bad in that session!", and then commented in the debriefing session that the he thought the intensity influenced his accuracy in implementing the BIP, although the data did not support this.

Error Analysis

An error analysis was conducted following the study to determine if there was a specific component of the behavior intervention plan that was associated with lower levels of integrity, indicating that this component may be more difficult. The number of correct responses for each component were summed across the five sessions in each condition and divided by the number correct plus incorrect responses for that component and then multiplied by 100 to obtain a percentage. The results yielded a percentage of correct responses for each component of the treatment integrity checklist, separated by condition.

Table 3 shows the percentages of correct implementation for each step of the procedure for participants who implemented the DRA protocol. Overall, there were high levels of treatment integrity across all treatment components and participants. However, all participants showed decreased levels of treatment integrity in the test conditions for the physical guidance of demands following problem behavior. P01 showed decreases in

several components during the spacing condition when compared to the control condition, including errors in three-step prompting, praise following compliance, delivering tokens, and physically guiding through with demands following problem behavior.

Table 4 shows the percentages of correct implementation for each step of the procedure for participants who implemented the DRO protocol. Compared to the DRA, levels of treatment integrity were generally lower across most components. Three out of four participants who implemented the DRO protocol showed decreased levels of treatment integrity for the component of resetting the DRO interval, which was a critical component of this intervention. This was the component with the lowest levels of treatment integrity across both the control and test conditions. Participants P04, P06, and P07 showed decreased levels of treatment integrity for resetting the DRO interval following problem behavior. Of these participants, one was in the spacing condition, and two were in the intensity condition. Participants also made errors on delivering praise and a token following the DRO interval when the confederate refrained from problem behavior, although the level of integrity varied across participants. All participants made errors on the component that involved delivering physical guidance following problem behavior. Integrity decreased from the control to the test condition with two participants (P04 and P06). Even though P07 did not show decreases in this component, the levels of treatment integrity for this component were low in the control and the test conditions. P06 showed decreases across several components including delivering praise following compliance, allowing the confederate to trade in tokens, allowing 15 s to consume the edible item, refraining from commenting or changing facial expressions following

problem behavior, using immediate physical guidance to complete demands following problem behavior, and resetting the DRO interval following problem behavior during the intensity condition when compared to the control condition.

Discussion

The purpose of the current study was to evaluate the effects of spacing and intensity of problem behavior on levels of treatment integrity in a translational study by asking participants to implement a BIP in the laboratory with a confederate. All participants maintained high levels of integrity when 70% of instances occurred within 5 s of the previous instance (spacing condition) or at a higher intensity topography (intensity condition). Six out of seven participants maintained levels of treatment integrity above 90%. P07, who participated in the DRO intensity condition, was the only participant who failed to maintain levels of integrity above 90%.

Despite the fact that most participants were able to implement the procedures well with irregular spacing or increased intensity, there were still some differences between DRO and DRA. Figure 5 shows the average means across conditions for DRA and DRO. Across both DRA and DRO, participants generally performed well on placing clear demands, using three-step prompting to obtain compliance (in the absence of problem behavior), delivering praise following compliance, allowing the confederate to trade in tokens, and allowing the confederate time to consume the edible she traded tokens for. However, participants' responses to problem behavior seemed most problematic across DRA and DRO, but more errors occurred in this area in the DRO condition. Globally, levels of treatment integrity were higher for participants implementing DRA compared to DRO. This may suggest that DRO is a more difficult intervention to implement,

especially when responding to instances of problem behavior. Individuals may require more extensive training to implement DRO with high levels of integrity. Anecdotally, the participants frequently made errors in the control condition of the DRO when a token delivery occurred within close temporal proximity to problem behavior. Because the instances of problem behavior were approximately 30 s apart in the control condition, as opposed to the spacing condition, this situation occurred more frequently in the control condition, which may explain the lower levels of integrity in the control condition (e.g., participants P03, P04, and P07).

Treatment integrity may be influenced by a variety of factors, including variable and unpredictable behavior from the client (Hogan et al., 2015). We evaluated intensity and spacing of problem behavior and did not observe consistently decreased levels of treatment integrity. However, there were some consistent decreases in the levels of treatment integrity during treatment components that involved responding to problem behavior in the test conditions. These decreased levels of treatment integrity for such components of the intervention may suggest that trainers should focus their efforts on training the individual's response to problem behavior. Previous research has shown that reinforcing problem behavior can be more detrimental to treatment outcomes than failing to reinforce appropriate behavior (Leon et al., 2014; St. Peter Pipkin et al., 2010). Participants in this study made more errors when responding to instances of problem behavior than errors in responding to instances of appropriate behavior (i.e., compliance or DRO interval elapse) (e.g., P04 implemented three-step prompting at higher levels of integrity than resetting the DRO interval in the spacing condition). Future research should further evaluate differences in the reinforcement procedures.

When training staff on a new procedure or to implement behavior interventions, it is common to use a 90% mastery criterion across two or three sessions (e.g., Hogan et al., 2015; Sarokaff & Sturmey, 2004). In this study, we used a 90% correct across two sessions criteria for mastery in the pretraining phase, and all but one participant maintained levels of treatment integrity above 90% even in the face of variable behavior (i.e., irregularly spaced or increased intensity). However, in response to problem behavior, all but one participant performed with below 90% treatment integrity (range, 45.5 % - 88.2%). Given this pattern emerged, the 90% correct treatment integrity criterion (which is generally accepted as a standard for implementation) may not be acceptable if the errors trainees are making are in response to problem behavior, as these errors are most detrimental to treatment effects. In the future, trainers should consider adopting a stricter criterion to determine mastery that takes into account each component of the treatment integrity checklist, and requires the trainee to master each component as well as have overall high levels of treatment integrity (e.g., require each component to have above 90% correct treatment integrity as well as an overall treatment integrity of 90%).

It is likely that multiple variables are in effect simultaneously in the natural environment that influence levels of treatment integrity. We did not observe consistent decreases in integrity when we evaluated spacing or intensity in isolation. It may be that our laboratory analogue was not similar enough to that natural environment to observe effects or it may be that negative effects on integrity are observed under a combination of these variables, including spacing, intensity, and other variables that were not evaluated during this study. Some examples of additional variables that could influence treatment

integrity could be competing responsibilities of the staff implementing the plan (e.g., staff are also required to take data, attend to other children, and implement the behavior plan), other topographies of non-targeted problem behavior (e.g., target behavior is aggression, but client begins engaging in inappropriate vocalizations), or other outside variables (e.g., sleep deprivation or food deprivation). Vollmer et al., (2008) suggested that the complexity of the protocol may influence levels of treatment integrity, or that decreased levels of treatment integrity could be a failure to generalize from the training environment to the natural environment. Future research should evaluate these variables to see if they influence the levels of treatment integrity.

There were several limitations to this study. One limitation is the experiment occurred immediately after participants were trained to implement these behavior plans. Therefore, this study only evaluated levels of integrity immediately after participants reached the mastery criterion (all sessions occurred within a 120-min period). It could be possible that levels of treatment integrity could be degraded by irregular spacing or increased intensity if there is a delay between the training and the implementation of the plan. These situations are common in the natural environment (e.g., staff go to training on Friday afternoon, and are required to implement the plan on Monday morning). Future research should evaluate how spacing and intensity of problem behavior effects staff performance when there is a delay between the training and the implementation.

Another limitation is that this study was conducted in an analogue setting. We conducted this study in an analogue setting so that the spacing and intensity of the behavior could be directly manipulated, which would not be possible outside of the laboratory setting. The results of this study may not generalize to natural situations when

staff are implementing behavior plans with clients or students. Future research should evaluate if the results from this study generalize to the classroom when teachers or paraprofessionals are implementing these behavior plans with children. Because we are unable to directly manipulate child behavior, future research could use correlational data to determine if variability of client behavior influences treatment integrity and then attempt to replicate these variables within a laboratory setting. Future research can evaluate other variables that could affect treatment integrity with confederates to systematically arrange variables and see how those arrangements influence staff performance. Future studies should continue to evaluate other variables (e.g., other students present other than the client, competing responsibilities for the staff, etc.) that could influence levels of treatment integrity and assess how such findings translate to the natural environment.

In summary, the current study used a laboratory model to evaluate if differences in spacing and intensity of problem behavior influenced the levels of integrity with which participants implemented DRA and DRO procedures. In general, treatment integrity remained high when participants implemented the procedures with regularly spaced and moderate intensity problem behavior and when exposed to either irregularly spaced or higher intensity problem behavior. However, participants made more errors across both BIPs when problem behavior occurred. In addition, participants seemed to have more difficulties implementing DRO than DRA. The findings of this study provide some initial evidence that we may want to reconsider the criterion which with we consider a trainee to have mastered a behavior intervention.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author

Athens, E. S., & Vollmer, T. R. (2010). An investigation of differential reinforcement of alternative behavior without extinction. *Journal of Applied Behavior Analysis, 43,* 569-589. doi:10.1901/jaba.2010.43-569

Call, N. A., Pabico, R. S., Findley, A. J., & Valentino, A. L. (2011). Differential reinforcement with and without blocking as treatment for elopement. *Journal of Applied Behavior Analysis, 44,* 903-907. doi:10.1901/jaba.2011.44-903

Carr, J. E., Severtson, J. M., & Lepper, T. L. (2009). Noncontingent reinforcement is an empirically supported treatment for problem behavior exhibited by individuals with developmental disabilities. *Research in Developmental Disabilities, 30,* 44-57. doi:10.1016/j.ridd.2008.03.002

Carroll, R. A., Kodak, T., & Fisher, W. W. (2013). An evaluation of programmed treatment-integrity errors during discrete-trial instruction. *Journal of Applied Behavior Analysis, 46,* 379-394. doi:10.1002/jaba.49

Cook, J. L., Rapp, J. T., & Schulze, K. A. (2015). Differential negative reinforcement of other behavior to increase wearing of a medical bracelet. *Journal of Applied Behavior Analysis, 48,* 901-906. doi:10.1002/jaba.228

Crone, R. M., & Shukla Mehta, S. (2016). Parent training on generalized use of behavior analytic strategies for decreasing the problem behavior of children with autism spectrum disorder: A data-based case study. *Education & Treatment of Children, 39,* 64-94.

DiGennaro Reed, F. D., Reed, D. D., Baez, C. N., & Maguire, H. (2011). A parametric analysis of errors of commission during discrete-trial training. *Journal of Applied Behavior Analysis, 44*, 611-615. doi:10.1901/jaba.2011.44-611

DiGennaro, F. D., Martens, B. K., & Kleinmann, A. E. (2007). A comparison of performance feedback procedures on teachers' treatment implementation integrity and students' inappropriate behavior in special education classrooms. *Journal of Applied Behavior Analysis*, *40*, 447-461. doi:10.1901/jaba.2007.40-447

Drasgow, E., Yell, M. L., Bradley, R., & Shriner, J. G. (1999). The IDEA Amendments of 1997: A school-wide model for conducting functional behavioral assessments and developing behavior intervention plans. *Education & Treatment of Children, 22*, 244-266.

Enloe, K. A., & Rapp, J. T. (2014). Effects of noncontingent social interaction on immediate and subsequent engagement in vocal and motor stereotypy in children with autism. *Behavior Modification*, *38*, 374-391. doi:10.1177/0145445513514081

Flynn, S. D., & Lo, Y. (2016). Teacher implementation of trial-based functional analysis and differential reinforcement of alternative behavior for students with challenging behavior. *Journal of Behavioral Education*, *25*, 1-31. doi:10.1007/s10864-015-9231-2

Franco, J. H., Lang, R. L., O'Reilly, M. F., Chan, J. M., Sigafoos, J., & Rispoli, M. (2009). Functional analysis and treatment of inappropriate vocalizations using a speech-generating device for a child with autism. *Focus on Autism and Other Developmental Disabilities*, *24*, 146-155. doi:10.1177/1088357609338380

Gabor, A. M., Fritz, J. N., Roath, C. T., Rothe, B. R., & Gourley, D. A. (2016). Caregiver preference for reinforcement-based interventions for problem behavior maintained by positive reinforcement. *Journal of Applied Behavior Analysis, 49,* 215-227. doi:10.1002/jaba.286

Goh, H., Iwata, B. A., & DeLeon, I. G. (2000). Competition between noncontingent and contingent reinforcement schedules during response acquisition. *Journal of Applied Behavior Analysis, 33,* 195-205. doi:10.1901/jaba.2000.33-195

Harriage, B., Cho Blair, K., & Miltenberger, R. (2016). An evaluation of a parent implemented in situ pedestrian safety skills intervention for individuals with autism. *Journal of Autism and Developmental Disorders, 46,* 2017-2027. doi:10.1007/s10803-016-2730-8

Hogan, A., Knez, N., & Kahng, S. (2015). Evaluating the use of behavioral skills training to improve school staffs' implementation of behavior intervention plans. *Journal of Behavioral Education, 24,* 242-254. doi:10.1007/s10864-014-9213-9

Individuals with Disabilities Education Improvement Act Amendments of 2004, Pub. L. No. 108-446, 118 Stat. 2647 (2004).

Johnson, B. M., Miltenberger, R. G., Egemo-Helm, K., Jostad, C. M., Flessner, C., & Gatheridge, B. (2005). Evaluation of behavioral skills training for teaching abduction-prevention skills to young children. *Journal of Applied Behavior Analysis, 38,* 67-78. doi:10.1901/jaba.2005.26-04

Kodak, T., Miltenberger, R. G., & Romaniuk, C. (2003a). A comparison of differential reinforcement and noncontingent reinforcement for the treatment of a child's

multiply controlled problem behavior. *Behavioral Interventions, 18,* 267-278. doi:10.1002/bin.143

Kodak, T., Miltenberger, R. G., & Romaniuk, C. (2003b). The effects of differential negative reinforcement of other behavior and noncontingent escape on compliance. *Journal of Applied Behavior Analysis, 36,* 379-382. doi:10.1901/jaba.2003.36-379

Lafasakis, M., & Sturmey, P. (2007). Training parent implementation of discrete-trial teaching: Effects on generalization of parent teaching and child correct responding. *Journal of Applied Behavior Analysis, 40,* 685-689. doi:10.1901/jaba.2007.685-689

Lanovaz, M. J., & Argumedes, M. (2010). Immediate and subsequent effects of differential reinforcement of other behavior and noncontingent matched stimulation on stereotypy. *Behavioral Interventions, 25,* 229-238.

LeGray, M. W., Dufrene, B. A., Sterling-Turner, H., Olmi, D. J., & Bellone, K. (2010). A comparison of function-based differential reinforcement interventions for children engaging in disruptive classroom behavior. *Journal of Behavioral Education, 19,* 185-204. doi:10.1007/s10864-010-9109-2

Leon, Y., Wilder, D. A., Majdalany, L., Myers, K., & Saini, V. (2014). Errors of omission and commission during alternative reinforcement of compliance: The effects of varying levels of treatment integrity. *Journal of Behavioral Education, 23,* 19-33. doi:10.1007/s10864-013-9181-5

Lerman, D. C., & Iwata, B. A. (1996). Developing a technology for the use of operant extinction in clinical settings: An examination of basic and applied research. *Journal of Applied Behavior Analysis, 29,* 345-382. doi:10.1901/jaba.1996.29-345

Lindberg, J. S., Iwata, B. A., Kahng, S., & DeLeon, I. G. (1999). DRO contingencies: An analysis of variable-momentary schedules. *Journal of Applied Behavior Analysis, 32,* 123-136. doi:10.1901/jaba.1999.32-123

Lustig, N. H., Ringdahl, J. E., Breznican, G., Romani, P., Scheib, M., & Vinquist, K. (2014). Evaluation and treatment of socially inappropriate stereotypy. *Journal of Developmental and Physical Disabilities, 26,* 225-235. doi:10.1007/s10882-013-9357-x

Matson, J. L., Hess, J. A., & Mahan, S. (2013). Moderating effects of challenging behaviors and communication deficits on social skills in children diagnosed with an Autism spectrum disorder. *Research in Autism Spectrum Disorders, 7,* 23-28. doi:10.1016/j.rasd.2012.07.002

Mazaleski, J. L., Iwata, B. A., Vollmer, T. R., Zarcone, J. R., & Smith, R. G. (1993). Analysis of the reinforcement and extinction components in DRO contingencies with self-injury. *Journal of Applied Behavior Analysis, 26,* 143-156. doi:10.1901/jaba.1993.26-143

Miles, N. I., & Wilder, D. A. (2009). The effects of behavioral skills training on caregiver implementation of guided compliance. *Journal of Applied Behavior Analysis, 42,* 405-410. doi:10.1901/jaba.2009.42-405

Neef, N. A. (1995). Pyramidal parent training by peers. *Journal of Applied Behavior Analysis, 28,* 333-337. doi:10.1901/jaba.1995.28-333

Nigro-Bruzzi, D., & Sturmey, P. (2010). The effects of behavioral skills training on mand training by staff and unprompted vocal mands by children. *Journal of Applied Behavior Analysis, 43,* 757-761. doi:10.1901/jaba.2010.43-757

Pence, S. T., St. Peter, C. C., & Giles, A. F. (2014). Teacher acquisition of functional analysis methods using pyramidal training. *Journal of Behavioral Education, 23,* 132-149. doi:10.1007/s10864-013-9182-4

Pence, S. T., St. Peter, C. C., & Tetreault, A. S. (2012). Increasing accurate preference assessment implementation through pyramidal training. *Journal of Applied Behavior Analysis, 45,* 345-359. doi:10.1901/jaba.2012.45-345

Petscher, E. S., & Bailey, J. S. (2008). Comparing main and collateral effects of extinction and differential reinforcement of alternative behavior. *Behavior Modification, 32,* 468-488. doi:10.1177/0145445507309032

Petscher, E. S., Rey, C., & Bailey, J. S. (2009). A review of empirical support for differential reinforcement of alternative behavior. *Research in Developmental Disabilities, 30,* 409-425. doi:10.1016/j.ridd.2008.08.008

Piazza, C. C., Hanley, G. P., & Fisher, W. W. (1996). Functional analysis and treatment of cigarette pica. *Journal of Applied Behavior Analysis, 29,* 437-450. doi:10.1901/jaba.1996.29-437

Repp, A. C., Barton, L. E., & Brulle, A. R. (1983). A comparison of two procedures for programming the differential reinforcement of other behaviors. *Journal of Applied Behavior Analysis, 16,* 435-445. doi:10.1901/jaba.1983.16-435

Richling, S. M., Rapp, J. T., Carroll, R. A., Smith, J. N., Nystedt, A., & Siewert, B. (2011). Using noncontingent reinforcement to increase compliance with wearing

prescription prostheses. *Journal of Applied Behavior Analysis*, *44*, 375-379. doi:10.1901/jaba.2011.44-375

Rispoli, M., Camargo, S., Machalicek, W., Lang, R., & Sigafoos, J. (2014). Functional communication training in the treatment of problem behavior maintained by access to rituals. *Journal of Applied Behavior Analysis*, *47*, 580-593. doi:10.1002/jaba.130

Rosales, R., Stone, K., & Rehfeldt, R. A. (2009). The effects of behavioral skills training on implementation of the picture exchange communication system. *Journal of Applied Behavior Analysis*, *42*, 541-549. doi:10.1901/jaba.2009.42-541

Sarokoff, R. A., & Sturmey, P. (2004). The effects of behavioral skills training on staff implementation of discrete-trial teaching. *Journal of Applied Behavior Analysis*, *37*, 535-538. doi:10.1901/jaba.2004.37-535

Schumacher, B. I., & Rapp, J. T. (2011). Increasing compliance with haircuts in a child with autism. *Behavioral Interventions*, *26*, 67-75. doi:10.1002/bin.321

Seiverling, L., Williams, K., Sturmey, P., & Hart, S. (2012). Effects of behavioral skills training on parental treatment of children's food selectivity. *Journal of Applied Behavior Analysis*, *45*, 197-203. doi:10.1901/jaba.2012.45-197

Shayne, R., & Miltenberger, R. G. (2013). Evaluation of behavioral skills training for teaching functional assessment and treatment selection skills to parents. *Behavioral Interventions*, *28*, 4-21. doi:10.1002/bin.1350

St. Peter Pipkin, C., Vollmer, T. R., & Sloman, K. N. (2010). Effects of treatment integrity failures during differential reinforcement of alternative behavior: A

translational model. *Journal of Applied Behavior Analysis, 43,* 47-70. doi:10.1901/jaba.2010.43-47

Tiger, J. H., Fisher, W. W., & Bouxsein, K. J. (2009). Therapist- and self-monitored DRO contingencies as a treatment for the self-injurious skin picking of a young man with Asperger syndrome. *Journal of Applied Behavior Analysis, 42,* 315-319. doi:10.1901/jaba.2009.42-315

van Camp, C. M., Lerman, D. C., Kelley, M. E., Contrucci, S. A., & Vorndran, C. M. (2000). Variable-time reinforcement schedules in the treatment of socially maintained problem behavior. *Journal of Applied Behavior Analysis, 33,* 545-557. doi:10.1901/jaba.2000.33-545

Vollmer, T. R., Ringdahl, J. E., Roane, H. S., & Marcus, B. A. (1997). Negative side effects of noncontingent reinforcement. *Journal of Applied Behavior Analysis, 30,* 161-164. doi:10.1901/jaba.1997.30-161

Vollmer, T. R., & Iwata, B. A. (1992). Differential reinforcement as treatment for behavior disorders: Procedural and functional variations. *Research in Developmental Disabilities, 13,* 393-417. doi:10.1016/0891-4222(92)90013-V

Vollmer, T. R., Iwata, B. A., Zarcone, J. R., Smith, R. G., & Mazaleski, J. L. (1993). The role of attention in the treatment of attention-maintained self-injurious behavior: Noncontingent reinforcement and differential reinforcement of other behavior. *Journal of Applied Behavior Analysis, 26,* 9–21. doi: 10.1901/jaba.1993.26-9

Vollmer, T. R., Marcus, B. A., & Ringdahl, J. E. (1995). Noncontingent escape as treatment for self-injurious behavior maintained by negative reinforcement. *Journal of Applied Behavior Analysis, 28,* 15-26. doi:10.1901/jaba.1995.28-15

Vollmer, T. R., Roane, H. S., Ringdahl, J. E., & Marcus, B. A. (1999). Evaluating treatment challenges with differential reinforcement of alternative behavior. *Journal of Applied Behavior Analysis*, *32*, 9-23. doi:10.1901/jaba.1999.32-9

Vollmer, T. R., Sloman, K. N., & Pipkin, C. P. (2008). Practical implications of data reliability and treatment integrity monitoring. *Behavior Analysis in Practice*, *1*(2), 4-11.

Wallace, M. D., Iwata, B. A., Hanley, G. P., Thompson, R. H., & Roscoe, E. M. (2012). Noncontingent reinforcement: A further examination of schedule effects during treatment. *Journal of Applied Behavior Analysis*, *45*(4), 709-719.

Ward-Horner, J., & Sturmey, P. (2012). Component analysis of behavior skills training in functional analysis. *Behavioral Interventions*, *27*, 75-92. doi:10.1002/bin.1339

Wilder, D. A., Normand, M., & Atwell, J. (2005). Noncontingent reinforcement as treatment for food refusal and associated self-injury. *Journal of Applied Behavior Analysis*, *38*, 549-553. doi:10.1901/jaba.2005.132-04

Wilder, D. A., Register, M., Register, S., Bajagic, V., & Neidert, P. L. (2009). Functional analysis and treatment of rumination using fixed-time delivery of a flavor spray. *Journal of Applied Behavior Analysis*, *42*, 877-882. doi:10.1901/jaba.2009.42-877

Table 1

Participant Demographic Information

Code	Sex	Age	Education Level	Reinforcement Procedure	Compensation
			Spacing		
P01	F	23	Senior, Psychology	DRA	Extra-Credit
P02	F	20	Junior, Psychology	DRA	Cash
P03	M	25	Senior, Psychology	DRO	Cash
P04	F	21	Senior, Psychology	DRO	Cash
			Intensity		
P04	F	21	Senior, Psychology	DRA	Cash
P05	F	24	First-year Master's Student, Applied Behavior Analysis	DRA	Cash
P06	F	25	Senior, Psychology	DRO	Extra-Credit
P07	M	19	Junior, Pre-Med	DRO	Extra-Credit

Table 2

Summary of Social Validity Survey Reports

Statement	Mean (*M*)	Range
The procedure I was trained on was easy to implement.	**4.5**	**2 – 5**
I feel comfortable implementing this procedure again in the future.	**4.75**	**4 – 5**
The trainer was knowledgeable about the procedure.	**5**	-
I think this procedure would work to reduce problem behavior of students in schools.	**4.25**	**3 – 5**
The target behaviors for these procedures (self-injurious behavior and disruption) were difficult to handle.	**2.5**	**1 – 5**

Table 3

Error Analysis for Participants Who Implemented the DRA Procedure

	P01		P02		P04		P05	
	Control	Spacing	Control	Spacing	Control	Intensity	Control	Intensity
Participant has demand materials present	100%	100%	100%	100%	100%	100%	100%	100%
Participant remains within 2 ft of the confederate (score incorrect each time participant is more than 2 ft away)	100%	100%	100%	100%	100%	100%	100%	100%
Participant delivers clear and concise demands (e.g., "sit down," "clap your hands")	100%	100%	100%	100%	100%	100%	100%	100%
Participant uses three-step prompting to gain compliance with demands (score as correct if participant delivers model within 3-5 s and physical prompting within 3-5 s of model)	100%	99.1%	94%	94.5%	100%	100%	100%	99.4%

Participant delivers enthusiastic behavior-specific praise and a token within 3 s following independent compliance e.g., "Great job clapping your hands! You earned a token")	100%	95.8%	96.2%	100%	100%	95.8%	100%	100%
Participant delivers behavior-specific praise 3 s for compliance following the model prompt (e.g., "Great job clapping your hands! "), but does not deliver a token	100%	98.5%	98.8%	95.4%	97.1%	100%	100%	100%
Participant allows the confederate to trade in tokens after earning 4 tokens for an edible item.	100%	100%	100%	100%	100%	100%	100%	83.3%
Participant allows 15 s (range 12 s – 18 s) to consume edible item. Participant presents a new demand after the allotted time has elapsed.	60%	20%	100%	100%	100%	100%	100%	100%

Participant does not comment or change facial expressions within 3 s following instances of target behavior	100%	100%	100%	98.1%	100%	100%	100%	100%
Given target behavior: Participant immediately (within 3 s) delivers physical guidance to complete the current demand. If a demand was not in place, therapist should deliver a new demand and deliver immediate physical guidance to gain compliance. Therapist does not deliver praise following this demand.	62.5%	42%	97.9%	94.1%	96%	94%	100%	95.9%

Table 4

Error Analysis for Participants Who Implemented the DRO Procedure

	P04		P03		P06		P07	
	Control	Spacing	Control	Spacing	Control	Intensity	Control	Intensity
Participant has demand materials present	100%	100%	100%	100%	100%	100%	100%	100%
Participant has timer present and set to 30 s. Timer should be placed within view of the confederate.	100%	100%	100%	50%	100%	100%	41.7%	100%
Participant remains within 2 ft of the confederate (score incorrect each time participant is more than 2 ft away)	100%	100%	100%	100%	100%	100%	100%	100%
Participant delivers clear and concise demands (e.g., “sit down,” “clap your hands”)	100%	100%	99.4%	100%	100%	100%	100%	100%
Participant uses three-step prompting to gain compliance with demands (score as correct if participant delivers model within 3-5 s and physical prompting within 3-5 s of model).	98.4%	100%	96.4%	88.6%	92.7%	95.3%	95.5%	99.3%
Participant delivers enthusiastic behavior-specific praise within 3 s following compliance	100%	100%	92%	96%	92%	88.5%	96.6%	98.3%

Participant delivers behavior-specific praise and a token within 3 s following the end of the DRO interval (DRO 30-s; e.g., "Great job keeping safe hands! You earned a token"	45.5%	97.1%	85.7%	93.1%	100%	100%	88.2%	92.3%
Participant allows the confederate to trade in tokens after earning 4 tokens for an edible item.	100%	100%	-	100%	100%	50%	100%	-
Participant allows 15 s (range 12 s – 18 s) to consume edible item. Participant presents a new demand after the allotted time has elapsed.	100%	100%	-	100%	50%	0%	33.3%	-
Participant does not comment or change facial expressions within 3 s following instances of target behavior	95.6%	100%	100%	100%	100%	98%	9.7%	4.4%
Given target behavior: Participant immediately (within 3 s) delivers physical guidance to complete the current demand. If a demand was not in place, therapist should deliver a new demand and deliver immediate physical guidance to gain compliance. Therapist does not deliver praise following this demand.	93.3%	89.8%	86%	95.9%	95.9%	88.2%	58.5%	60.9%
Participant resets the DRO interval within 3 s of each occurrence of problem behavior.	78.7%	77.4%	74.5%	88%	98%	86%	61%	56.3%

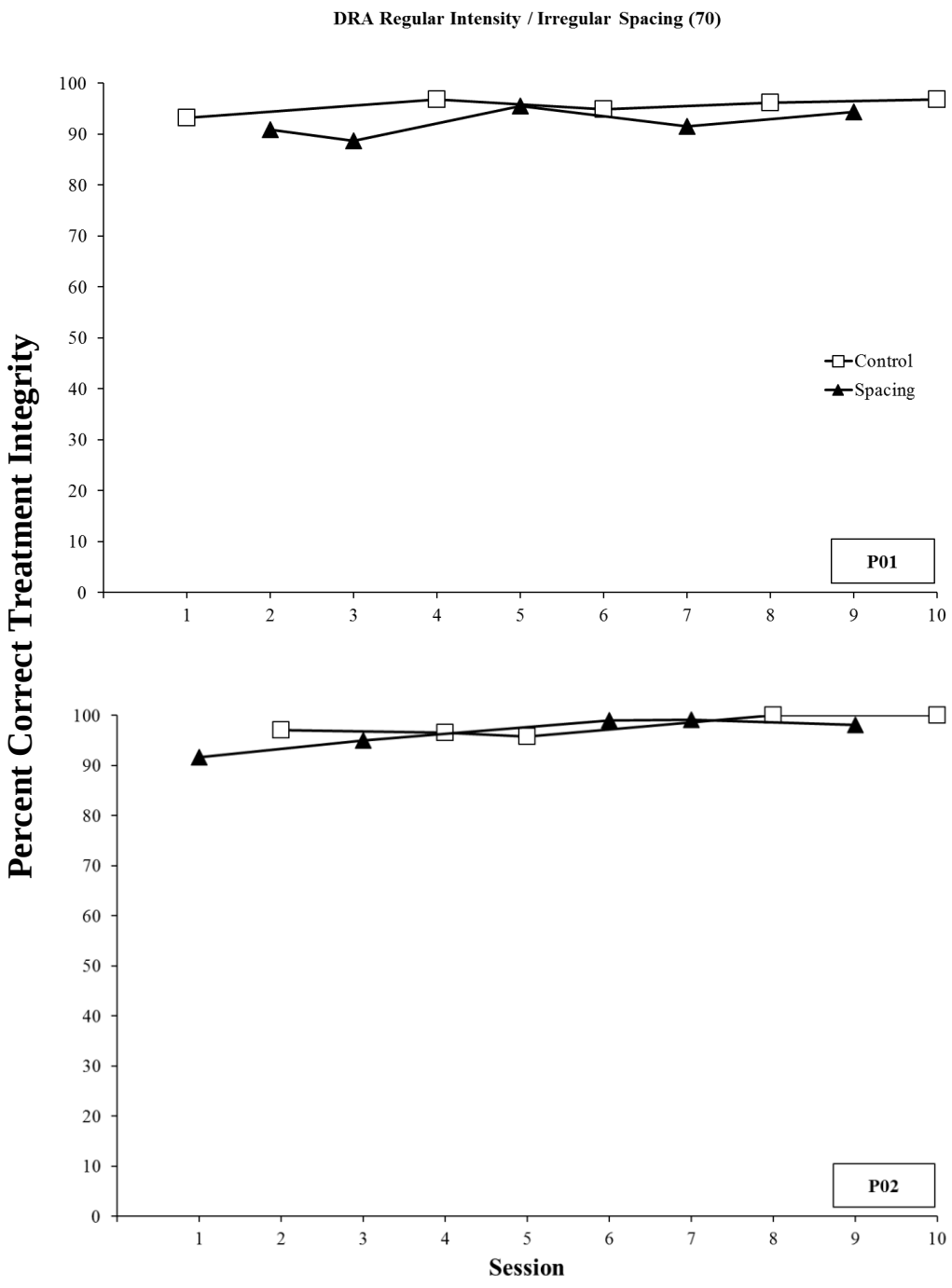


Figure 1. Percentage of correct responses across sessions for P01 (top panel) and P02 (bottom panel) in the DRA spacing 70 (solid triangles) and DRA control (open squares).

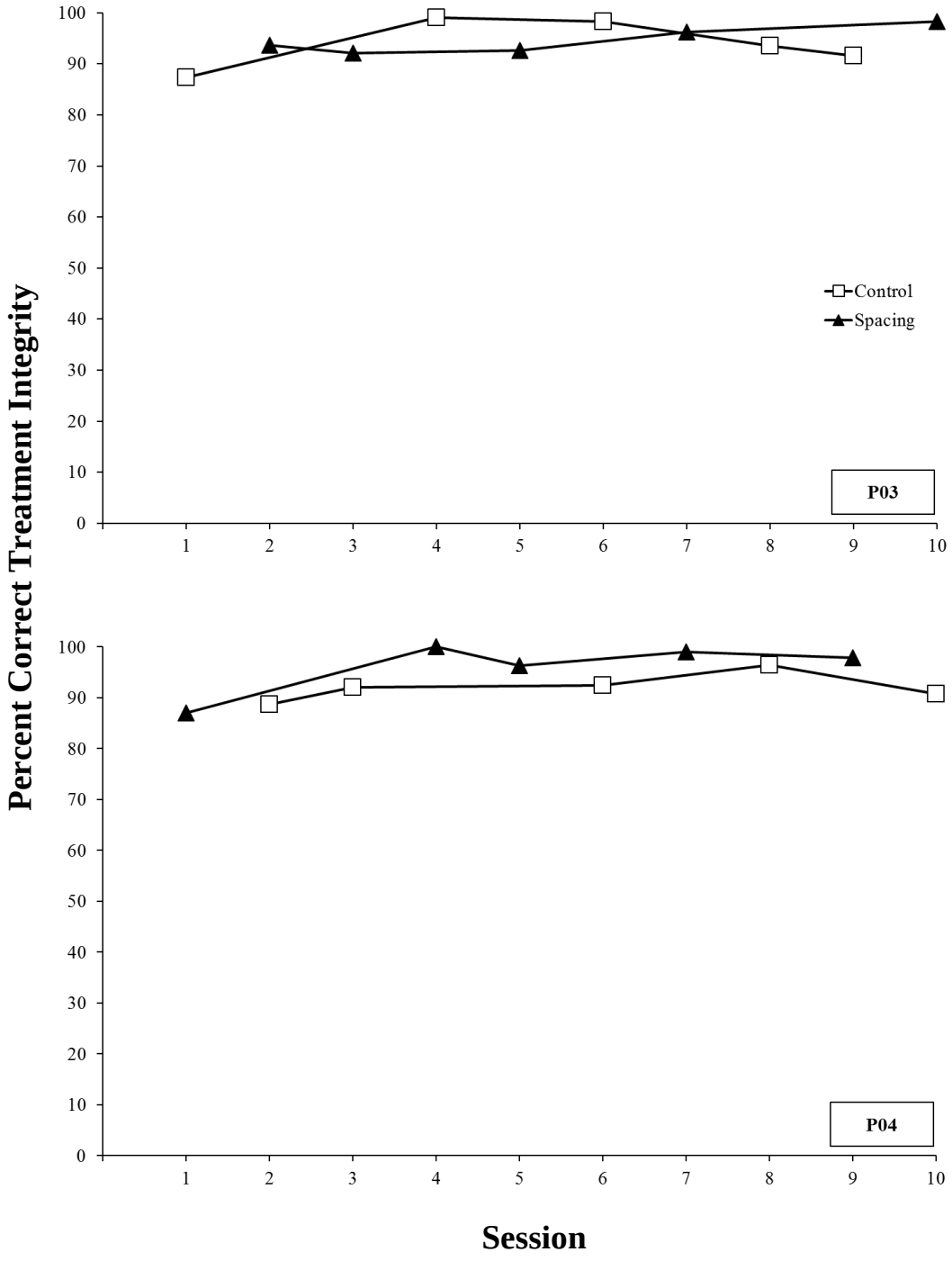


Figure 2. Percentage of correct responses across sessions for P03 (top panel) and P04 (bottom panel) in the DRO spacing 70 (solid triangles) and DRO control (open squares).

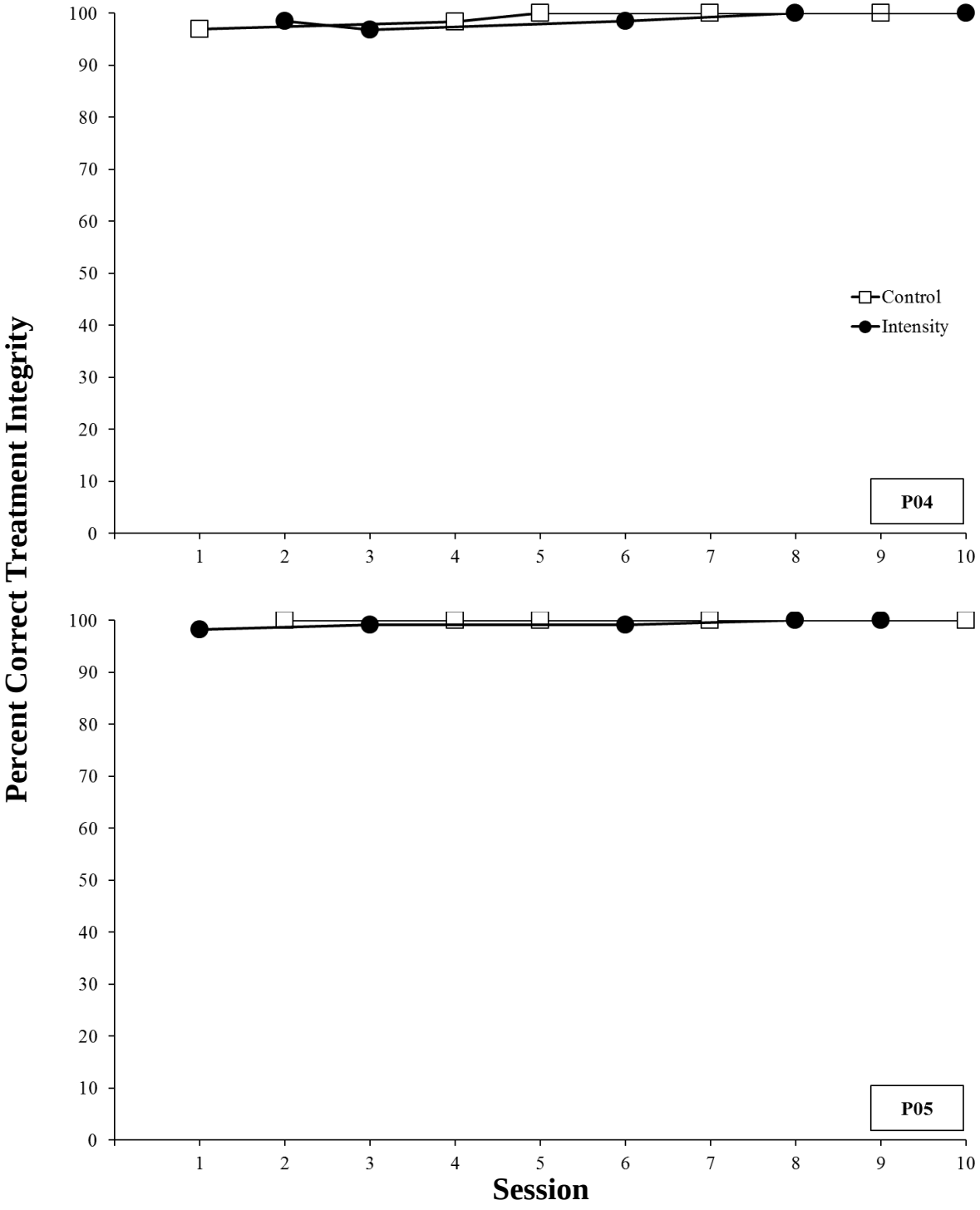


Figure 3. Percentage of correct responses across sessions for P04 (top panel) and P05 (bottom panel) in the DRA intensity 70 (solid circles) and DRA control (open squares).

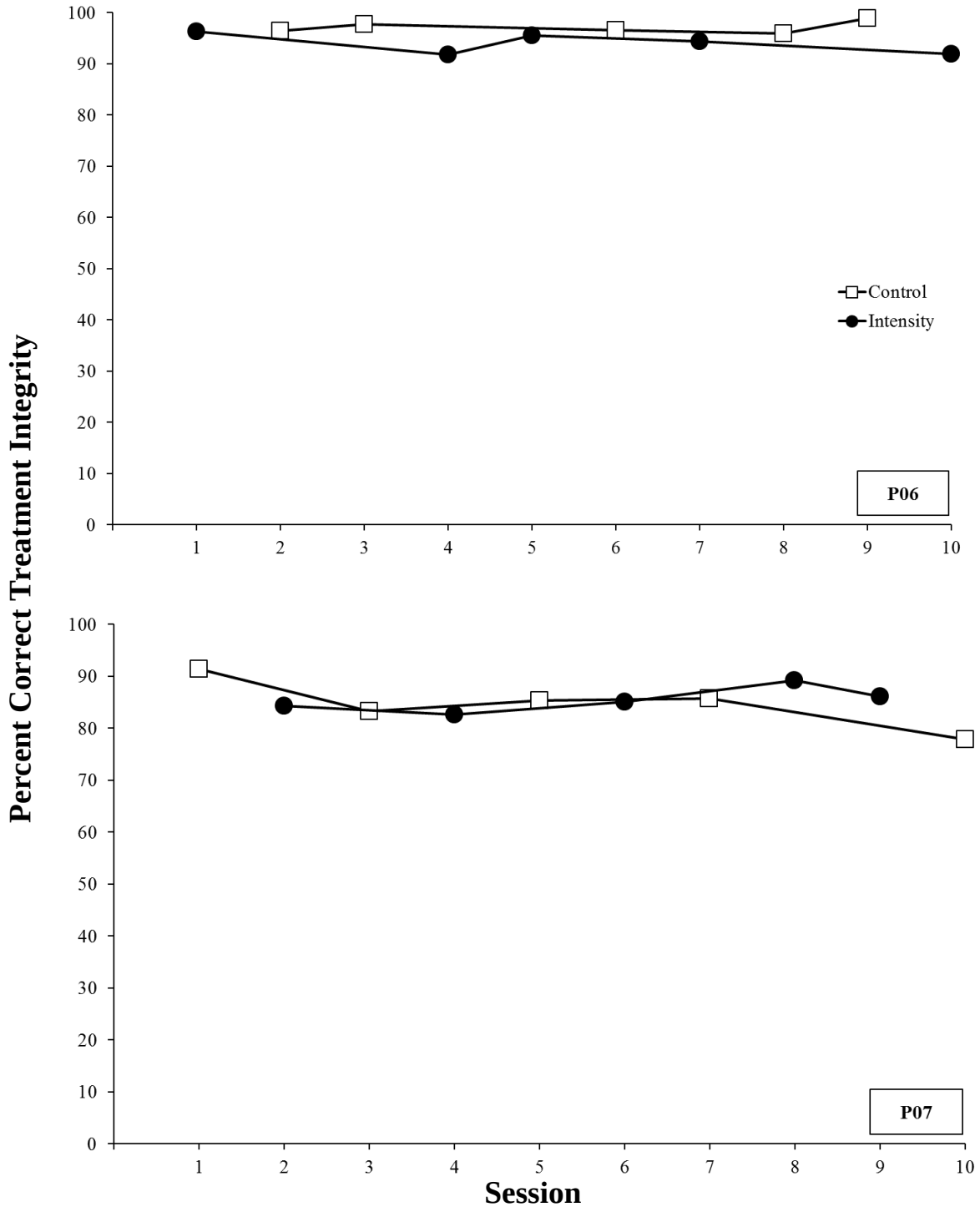


Figure 4. Percentage of correct responses across sessions for P06 (top panel) and P07 (bottom panel) in the DRO intensity 70 (solid circles) and DRO control (open squares).

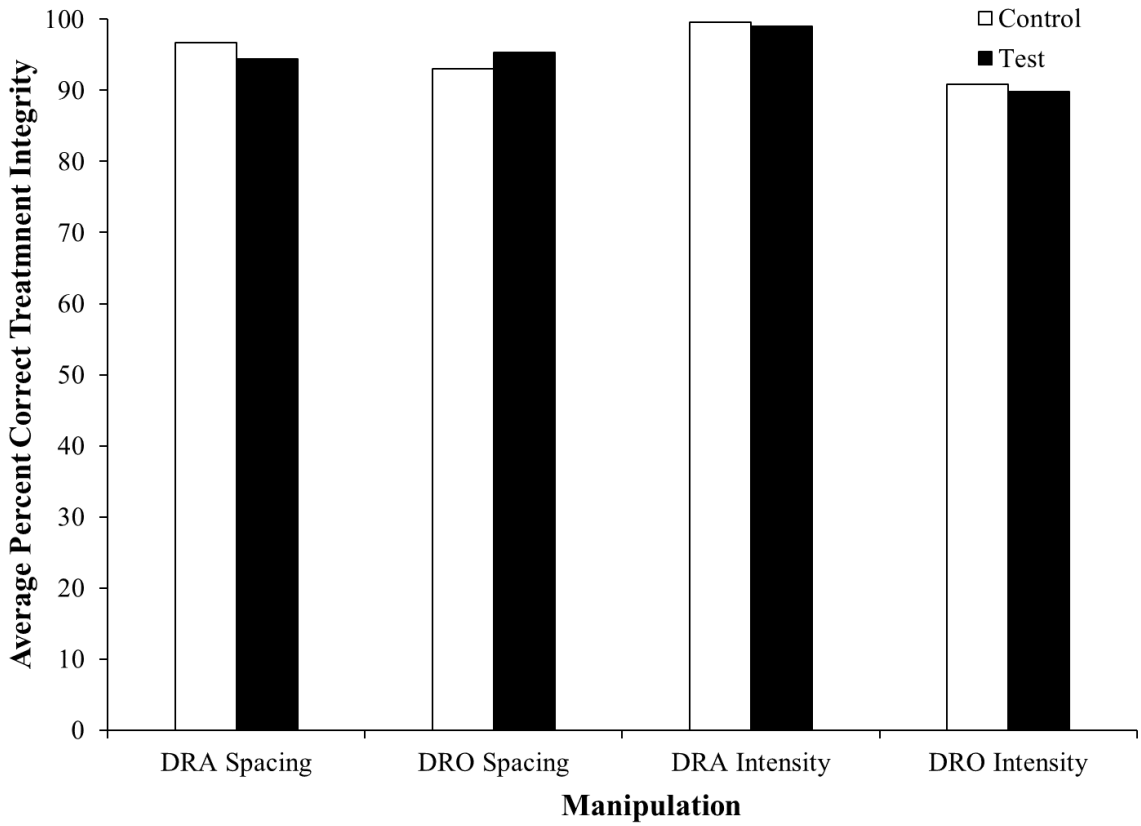


Figure 5. Average percentage of correct treatment integrity of the control condition (white bars) and the test condition (black bars) across manipulations.

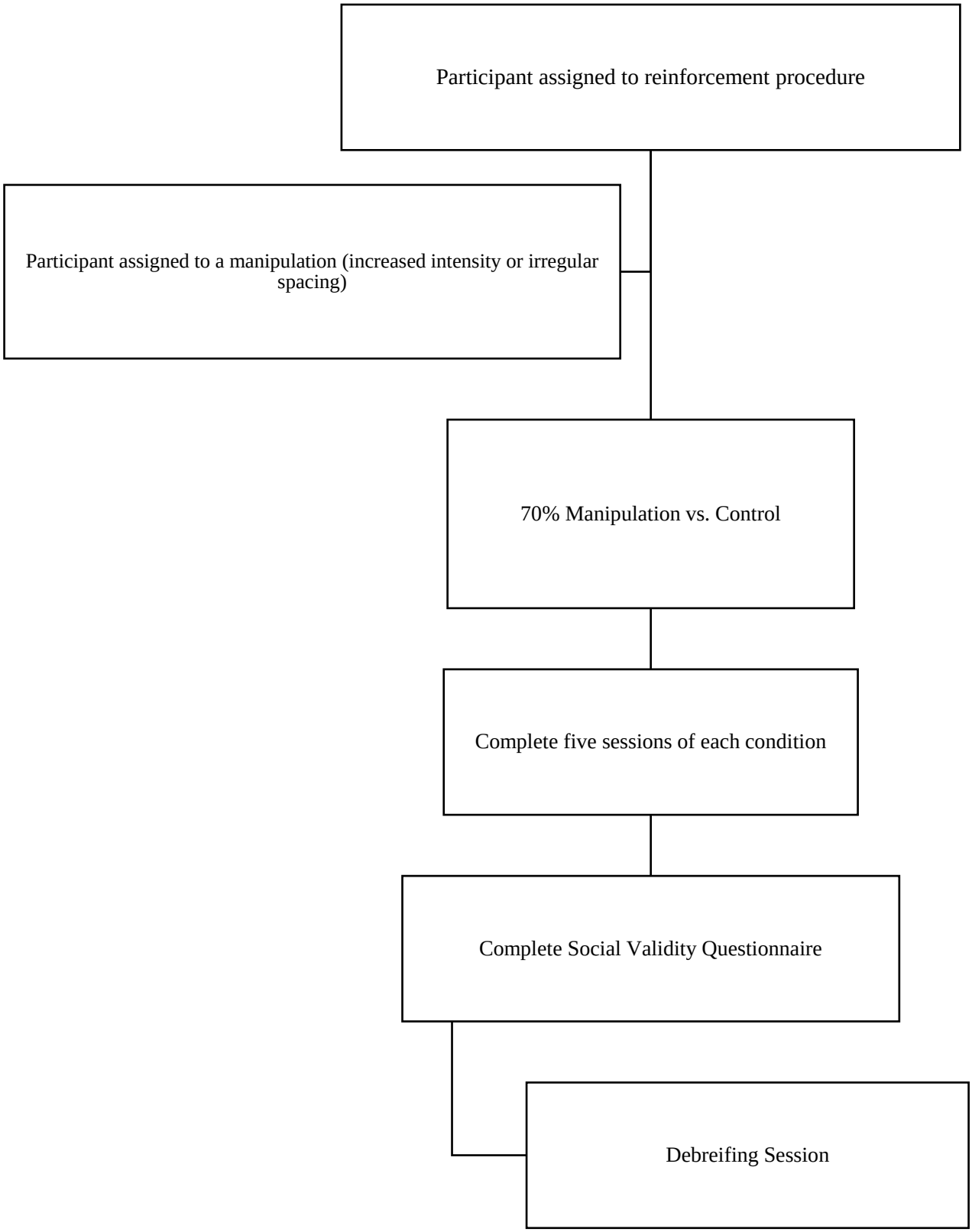
Appendix A – DRA Treatment Integrity Sheet

Participant Code: _____ **Script Version: _____**	**Date: _____**	**Condition: _____**
Environmental Set Up	**Correct**	**Incorrect**
Participant has demand materials present		
Participant remains within 2 ft of the confederate (score incorrect each time participant is more than 2 ft away)		
General Procedures		
Participant delivers clear and concise demands (e.g., “sit down,” “clap your hands”)		
Participant uses three-step prompting to gain compliance with demands (score as correct if participant delivers model within 3-5 s and physical prompting within 3-5 s of model)		
Participant delivers enthusiastic behavior-specific praise and a token within 3 s following independent compliance e.g., "Great job clapping your hands! You earned a token")		
Participant delivers behavior-specific praise 3 s for compliance following the model prompt (e.g., "Great job clapping your hands! "), but does not deliver a token		
Participant allows the confederate to trade in tokens after earning 4 tokens for an edible item.		
Participant allows 15 s (range 12 s – 18 s) to consume edible item. Participant presents a new demand after the allotted time has elapsed.		
Participant does not comment or change facial expressions within 3 s following instances of target behavior		
Given target behavior: Participant immediately (within 3 s) delivers physical guidance to complete the current demand. If a demand was not in place, therapist should deliver a new demand and deliver immediate physical guidance to gain compliance. Therapist does not deliver praise following this demand.		
Total		
Total Opportunities		
Percent Correct Treatment Integrity		

Appendix B – DRO Treatment Integrity Sheet

Participant Code: _____ Script Version: _____	**Date: _____**	**Condition: _____**
Environmental Set Up	**Correct**	**Incorrect**
Participant has demand materials present		
Participant has timer present and set to 30 s. Timer should be placed within view of the confederate.		
Participant remains within 2 ft of the confederate (score incorrect each time participant is more than 2 ft away)		
General Procedures		
Participant delivers clear and concise demands (e.g., "sit down," "clap your hands")		
Participant uses three-step prompting to gain compliance with demands (score as correct if participant delivers model within 3-5 s and physical prompting within 3-5 s of model).		
Participant delivers enthusiastic behavior-specific praise within 3 s following compliance		
Participant delivers behavior-specific praise and a token within 3 s following the end of the DRO interval (DRO 30-s; e.g., "Great job keeping safe hands! You earned a token"		
Participant allows the confederate to trade in tokens after earning 4 tokens for an edible item.		
Participant allows 15 s (range 12 s – 18 s) to consume edible item. Participant presents a new demand after the allotted time has elapsed.		
Participant does not comment or change facial expressions within 3 s following instances of target behavior		
Given target behavior: Participant immediately (within 3 s) delivers physical guidance to complete the current demand. If a demand was not in place, therapist should deliver a new demand and deliver immediate physical guidance to gain compliance. Therapist does not deliver praise following this demand.		
Participant resets the DRO interval within 3 s of each occurrence of problem behavior.		
Total		
Total Opportunities		
Percent Correct Treatment Integrity		

Appendix C – Flow of Procedures



Appendix D – BST Instructions Script (Example)

Experimenter: Today you will be learning to implement differential reinforcement of alternative behavior, or a DRA procedure. First I will give you some information about what DRA is, how it's used, and show you how to implement it within the context of a behavior intervention plan, or a BIP.

Do you have any questions?

Instructions:

Experimenter: Differential reinforcement means delivering reinforcers for some behaviors, but not others. Specifically, within Applied Behavior Analysis, differential reinforcement is often used to decrease problem behavior. In addition, differential reinforcement of alternative behavior increases a more appropriate behavior. During DRA, a specific behavior is selected as the appropriate behavior to increase. For example, with disruptive behavior, the therapist would not provide the reinforcer, but provide it instead for a more appropriate behavior, like following instructions or asking for a break from work.

Do you have any questions?

Instructions w/ Modeling:

Today I will be teaching you to implement a behavior intervention plan that includes DRA. Here is a written copy of the BIP for your reference. [Experimenter gives participant a copy of the DRA BIP].

The top section reviews operational definitions. This just describes exactly which behaviors we are targeting and how they are defined. Self-injurious behavior is defined as any instance of contact with any part of the body to another part of the body (including biting) or surface from a distance of 6 inches or greater. This would include any biting which looks like this [therapist models biting hand, arm, leg]. It would also include hitting other parts of the individual's body from 6 inches or greater, which would include behaviors like this [therapist hits wall and table from 6 inches, hits body from 6 inches], but would not include this [therapist repeats previous behaviors, but from 3 inches]. Disruption is defined as any instance of ripping, tearing, or swiping materials, clothing; any instance of the displacement of furniture greater than 1 foot; any instance of throwing materials 1 foot or greater. Some examples of this would be if an individual ripped any papers or clothing like this [therapist rips paper], swiping materials like this [therapist swipes work materials], moving furniture greater than 1 ft [therapist moves chair 1 ft] but not if it is less than 1 ft [therapist moves furniture less than 1 ft]. Finally, property destruction includes throwing items greater than 1 ft [therapist gives examples of traveling 1 ft or greater, and examples of less than 1 ft].

Do you have any questions?

The next section reviews antecedent manipulations, which are things we can do before the behavior occurs to make it less likely to occur. [Therapist reads antecedent manipulations listed on BIP, providing examples and non-examples of each antecedent manipulation].

Do you have any questions?

The next section reviews reinforcement and behavior management strategies. These are the procedures to follow when the individual engages in appropriate behavior or inappropriate behavior. These procedures are followed after the behavior has occurred.

[Therapist reads each of the procedures and gives examples and non-examples of following each strategy].
Do you have any questions?
Now I will show you quickly how to implement this BIP with a confederate. This is [confederate's name], and she/he will be playing the role of our client today.
[Confederate and Experimenter follow procedures of BIP for 2.5 min. Confederate engages in appropriate and inappropriate behaviors].
Do you have any questions?
Role plays and Feedback:
Now it's your turn to practice.

Appendix E – Examples of Timing Scripts

Minute 0-1																													
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	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

Minute 1-2																													
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	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

Minute 2-3																													
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	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

Minute 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	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

Minute 4-5																													
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	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

Legend
DRO Interval Elapse
Compliance
Regular Intensity SIB
Increased Intensity SIB
Regular Intensity DIS
Increased Intensity DIS

Example 1. DRO Regular Spacing/Regular Intensity.

Minute 0-1																													
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	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

Minute 1-2																													
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	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

Minute 2-3																													
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	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

Minute 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	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

Minute 4-5																													
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	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

Legend
DRO Interval Elapse
Compliance
Regular Intensity SIB
Increased Intensity SIB
Regular Intensity DIS
Increased Intensity DIS

Example 2. DRO Regular Spacing/Increased Intensity (100).

Appendix F – Social Validity Questionnaire

Instructions: Please rank the following statements on a 1 (strongly disagree) to 5 (strongly agree) point scale. Circle the number you feel best represents your opinions regarding your participation in the study. Please answer all questions. After you have finished, place your paper in the provided envelope and seal it. Your responses will not be reviewed until the conclusion of this study for all participants, and your responses will not affect your compensation for participation or your standing with Auburn University. Please include any additional comments that you think are relevant.

Statement	**1 (strongly disagree)**	**2 (disagree)**	**3 (neutral – neither agree nor disagree)**	**4 (agree)**	**5 (strongly agree)**
The procedure I was trained on was easy to implement.	**1**	**2**	**3**	**4**	**5**
I feel comfortable implementing this procedure again in the future.	**1**	**2**	**3**	**4**	**5**
The trainer was knowledgeable about the procedure.	**1**	**2**	**3**	**4**	**5**
I think this procedure would work to reduce problem behavior of students in schools.	**1**	**2**	**3**	**4**	**5**
The target behaviors for these procedures (self-injurious behavior and disruption) were difficult to handle.	**1**	**2**	**3**	**4**	**5**
Additional Comments:					

Appendix G – Debriefing Script

Debriefing Form

For the Study entitled:

Effects of Intensity and Spacing of Behavior on Levels of Treatment Integrity

Dear Participant,

During this study, you were asked to implement a reinforcement procedure to the best of your abilities. You were told that the purpose of the study was to see how well you could do implementing a reinforcement procedure. The actual purpose of the study was to see if the magnitude or the spacing of simulated problem behavior would affect how well you did implementing the reinforcement procedure. We did not tell you everything about the purpose of the study because we didn't want you to act differently on purpose when higher magnitude behavior or bursts of behaviors occurred.

The reinforcement procedure you implemented is similar to behavior intervention plans that are used to reduce problem behavior with people with autism spectrum disorder and developmental disabilities. The information we learn from how you preformed will help us identify factors that influence treatment integrity in the natural environment. We want to remind you that the individual you implemented the reinforcement procedure with was a confederate in the study and did not have any developmental or intellectual delays.

You are reminded that your original consent document included the following information: you have the right to withdraw from the study at any time. If you have any concerns about your participation or the data you provided in light of this disclosure, please discuss this with us. We will be happy to provide any information we can to help answer questions you have about this study. If your concerns are such that you would now like to have your data withdrawn, and the data is identifiable, we will do so.

If you have questions about your participation in the study, please contact me at sbh0015@tigermail.auburn.edu, or my faculty advisor, Sacha Pence at sachapence@auburn.edu. If you have questions about your rights as a research participant, you may contact the Office of Research Compliance (334-844-5966, IRBadmin@auburn.edu or an Auburn University Institutional Review Board (IRBChair@auburn.edu). If you have experienced distress as a result of your participation in this study, a referral list of mental health providers is attached to this document for your use. (Please remember that any cost in seeking medical assistance is at your own expense.)

Please again accept our appreciation for your participation in this study.

_____ Date: _____

Participant Signature

_____ Date: _____

Sarah Haygood Signature

Appendix I – Psychological Resources Available

Individual Counseling
Student Counseling Services (SCS) utilizes a brief-treatment model. SCS offers enrolled Auburn University students ten (10) individual counseling sessions per academic year. On a case-by-case basis, the SCS Case Review Team will consider extending the number of individual counseling sessions if it is clinically-indicated.
Website: http://wp.auburn.edu/scs/counseling/
Phone Number: (334) 844-5123

Auburn University Medical Clinic
Auburn University Medical Clinic (AUMC) has physicians, nurse practitioners, physician assistants and a full nursing staff to serve students. The AUMC has a full lab, x-ray facilities, and a massage therapist. Pharmacy Services through the School of Pharmacy are available on-site. The Clinic handles all types of medical services, including women's healthcare.
Website: https://cws.auburn.edu/aumc//
Phone Number: (334) 844-4416

Auburn University Psychological Services Center (AUPSC)
AUPSC is a training clinic provided by the Department of Psychology at Auburn University. Graduate students in doctoral training for clinical psychology provide individual and group therapy. Services are provided under the supervision of licensed clinical psychologists. Cost of therapy typically ranges from $25 to $55 per fifty-minute session. AUPSC does not bill insurance. All therapy clients are charged $75 for their initial intake appointment, which typically lasts two hours.
Website: http://www.cla.auburn.edu/psychology/aupsc/
Phone Number: (334) 844-4889

Health Behavior Assessment Center (HBAC)
HBAC provides the Brief Alcohol Screening and Intervention for College Students (BASICS) curriculum, which includes an alcohol use evaluation along with detailed personal drinking feedback and advice to provide lifestyle feedback and encourage positive life change. Two meetings are required and information is confidential. Sessions are free to AU students who self-refer or are referred by a health professional (including Student Counseling Service clinicians). Students who are referred as a result of a legal or disciplinary action will be charged $40. Housed in the AU Psychological Services Center, HBAC does not bill insurance companies.
Website: http://www.cla.auburn.edu/psychology/hbac/
Phone Number: (334) 844-4889

Tiger Cub
The Tiger Cub is Auburn University's student planner and online handbook. It contains information pertaining to student organizations, activities, academic rules, and other information aimed at helping students adjust to college life.
Website: http://www.auburn.edu/student_info/student_policies/
Phone Number: (334) 844-5176

Disclaimer
These resources are provided as a courtesy. They should not be construed as an endorsement by Auburn University, but are merely provided for your information and convenience.