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Teaching tolerance for delay of reinforcement to reduce a tangibly motivated behavior

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Teaching Tolerance for Delay of Reinforcement to Reduce a Tangibly Motivated
Behavior

A Thesis Presented

By

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Abstract

Identifying antecedent events can reduce problem behavior by manipulating the environmental event that precedes the behavior. An antecedent procedure commonly used to reduce problem behavior by increasing adaptive responding in individuals with developmental disabilities is functional communication training (FCT). However, one challenge of employing FCT as a treatment is that reinforcement for appropriate communication may not always be immediate or possible in the natural environment. In the current study, we taught tolerance for delay of reinforcement through thinning the schedule of reinforcement during FCT. After conducting a functional analysis, FCT with extinction was used to teach an appropriate alternative response to gain access to tangible items. The schedule of reinforcement was then gradually thinned to 1 minute. Results revealed that schedule thinning during FCT with extinction is an effective method for teaching tolerance for delay of reinforcement.

Teaching Tolerance for Delay of Reinforcement to Reduce a Tangibly Motivated Behavior

A primary goal of applied research is to change behavior that is socially significant (Baer, Wolf, & Risley, 1968). For the most part, applied behavior analysts have presumed that operant behavior occurs, or does not occur, as a function of its consequences (Smith & Iwata, 1997). As a result, manipulating a behavior's consequences has been the most preferred method behavior analysts use to produce behavior changes. Therefore, applied research has naturally focused on well-established consequent interventions, such as reinforcement and punishment, rather than on antecedent events, whose influence on behavior has often been thought to be secondary to and derived from consequences (Smith & Iwata, 1997). Smith and Iwata state that only 11.1% of subjects treated for maladaptive behaviors received treatment that was primarily based on the manipulation of antecedent variables. However, effective interventions must be more than combinations of consequence-based procedures (Horner & Harvey, 2000). Considering this, researchers should give equal attention to the identification and manipulation of antecedent variables. Horner and Harvey explain that it is important "to identify events that reliably occasion problem behavior and to engineer environments that minimize access to these antecedent events" (p. 644). Furthermore, when interventions focus specifically on consequences, there is a lack of clarity on how to describe antecedent variables (Horner & Harvey, 2000). Smith and Iwata explain that this lack of clarity may cause overall disagreement on a conceptual framework for describing and interpreting antecedent variables.

Over the past few years, behavior analysts have begun to realize that interventions might be strengthened if they focus on all facets of the 3-term contingency rather than just one. The 3-term contingency consists of an antecedent, the environmental event that occurs prior to the behavior, the behavior, and a consequence, the event that occurs following the behavior and may maintain the behavior if followed by an event that is reinforcing (Kern, Choutka, & Sokol, 2002). Antecedent based interventions focus on reducing the probability of a behavior occurring rather than imposing a consequence following the occurrence of a behavior. Thus, antecedent based interventions can be considered proactive and preventive rather than reactive (Kern et al., 2002). Moreover, this may reduce or eliminate the need for punishment procedures (Kern et al., 2002). Previous research using antecedent analyses has demonstrated the importance of identifying antecedent events for controlling behavior. In 1992, Cooper, Wacker, Thursby, et al. evaluated the effects of task preference, task demands, and adult attention on child behavior. Brief functional analyses were conducted to identify variables that facilitated appropriate behavior. Results demonstrated distinct patterns of performance for 8 out of 10 children. Three children displayed improved behavior with changes in task demands, one child displayed improved behavior with a preferred task, and four children displayed improved behavior with changes in adult attention.

Antecedent interventions concentrate on two classes of events. The first class of events, discriminative stimulus, is an event that serves as a signal that a particular behavior will be reinforced (Kern et al. 2002). Behavior that follows a discriminative stimulus is likely to continue to occur if the behavior is reinforced. In all cases, discriminative stimuli precede appropriate behavior. However, discriminative stimuli can

set the occasion for challenging behavior and become the focus of an intervention (Kern et al., 2002).

A second class of antecedent interventions is motivating operations. A motivating operation is “a variable that momentarily alters the reinforcing effectiveness of some other object or event” (Smith & Iwata, 1997, p. 348). Although motivating operations occur prior to a behavior, they typically occur at a time that is distant from the behavior. In addition, motivating operations can either increase (establishing operation) or decrease (abolishing operation) the likelihood a reinforcer will be effective. Identifying antecedent events can reduce problem behavior by using motivating operations to manipulate those environmental events (Smith & Iwata, 1997). Skinner explains that understanding the antecedent is necessary when using motivating operations to reduce problem behavior because events can alter response probabilities. In other words, with access to reinforcement held constant, behavior may be increased or decreased through deprivation or satiation (Smith & Iwata, 1997).

Vollmer, Iwata, Zarcone, Smith, and Mazaleski (1993) examined the role of satiation in reducing problem behavior maintained by attention. A functional analysis was conducted, suggesting self-injurious behavior was maintained by attention. A schedule of noncontingent reinforcement followed the functional analysis in which attention was initially provided in 100% of intervals. Attention was then faded systematically to a fixed time 5-minute schedule. The positive effects of noncontingent reinforcement were credited to a combination of extinction of self-injurious behavior and the elimination of the reinforcing effectiveness of attention. Extinction may have

occurred when the schedule was gradually thinned because responses that occurred during interreinforcement intervals were not followed by attention.

As mentioned previously, antecedent interventions typically involve environmental rearrangement. In other words, variables or conditions that occur prior to problem behavior are “altered in some way so that they are no longer present in a manner that is likely to provoke or set the occasion for the behavior to occur” (Kern et al. 2002, p. 114). If antecedent interventions are used in combination with other intervention approaches they may decrease aberrant behavior, such as self-injurious behavior, aggression, and tantrum, while increasing desired behavior such as engagement, work productivity, and appropriate social behaviors. In certain cases, antecedent interventions may not directly correspond to specific maintaining variables. That is, the effects of manipulating antecedent variables may not always depend upon a known relationship with consequences for problem behavior (Smith & Iwata, 1997). A possible example is the use of an enriched environment, in which noncontingently available reinforcers may substitute for the reinforcement that maintains problem behavior. Therefore, identifying the specific reinforcer that maintains problem behavior may not be necessary for a treatment such as this to be successful.

Antecedent intervention approaches are relatively new and a number of questions remain regarding their utility (Kern et al., 2002). Although antecedents are often manipulated or at least controlled in the assessment and treatment of problem behavior, few studies have done so in a manner that “permits the systematic identification of antecedent classes” (Smith & Iwata, 1997, p. 369). In addition, studies have yet to attempt to relate the effects of antecedents to basic principles of behavior. A primary

goal of research on antecedent variables should include the development of research methods that permit experimentally sufficient effects and conceptually coherent understandings of the role of antecedents (Smith & Iwata, 1997).

Very few studies have systematically manipulated only antecedent events to reduce problem behaviors maintained by positive reinforcement. Smith and Iwata (1997) explain that antecedent interventions designed for problem behavior maintained by positive reinforcement “typically involve a manipulation of putative establishing events to reduce the motivation to engage in the behavior” (p. 359).

Mace and Lalli (1991) examined the use of scheduled attention with extinction to reduce inappropriate vocalizations maintained by contingent disapproval. Results indicated that vocalizations decreased and were maintained at low rates using a variable interval 90 s schedule of attention, even when contingent social disapproval was reinstated. These results suggest that although extinction may be necessary for initial noncontingent reinforcement effects, it may not be critical for maintenance of the intervention.

In 2003, McComas, Thompson, and Johnson assessed the use of pre-session attention to reduce problem behavior maintained by attention and escape. Results demonstrated that subjects who displayed problem behavior maintained by attention exhibited fewer instances of the behavior following pre-session attention than when there was no pre-session attention. However, there was no effect on behavior maintained by escape. These results suggest that pre-session attention can serve as an abolishing operation for attention as a positive reinforcer.

Roantree and Kennedy (2006) examined whether pre-session attention could function as an establishing operation rather than an abolishing operation. When stereotypy was assessed in a functional analysis, the results were undifferentiated. However, when noncontingent attention was provided 20 minutes prior to the sessions, results indicated the behavior to be maintained by social attention. This outcome suggests that the antecedent manipulation functioned as an establishing operation; however, pre-session attention can serve as both an abolishing operation and an establishing operation.

Negatively reinforced problem behaviors present an opportunity for high levels of control by antecedent events by controlling the presentation of the stimuli that occasion escape responses (Smith & Iwata, 1997). Smith and Iwata explain that “the most obvious and direct method of reducing escape behavior involves elimination of aversive events from the environment” (p. 361). Carr, Newsom, and Binkoff (1976) demonstrated that task demands, (e.g. “Point to the window”) caused the onset of self-injurious behavior, but not social comments (e.g. “It’s a sunny day). Self-injurious behavior was reduced to near-zero levels by interspersing task demands at low rates among high rates of social comments. However, the frequency of demands was not increased relative to social comments over time.

Weeks and Gaylord-Ross (1981) examined fading among task difficulty by altering the physical characteristics of stimuli. Results demonstrated low levels of problem behavior when escape producing stimuli, the difficult tasks, were removed and gradually faded into training with “easy” tasks. However, a concern of using fading

alone is that there is no procedure in place to suppress problem behavior if it reoccurs during fading.

Pace, Iwata, Cowerdy, Andree, and McIntyre (1993) examined combining antecedent and consequent approaches using stimulus fading. They used a stimulus fading procedure based on frequency rather than task difficulty, in addition to escape extinction. Results demonstrated that combining treatments produced immediate and large reductions in self-injury that were maintained as the frequency of instructions was increased.

Ebanks and Fisher (2003) examined the effects of a teaching strategy in which easy tasks were interspersed with difficult tasks and corrective feedback was delayed and made less important by providing the corrective feedback as an antecedent prompt the next time a failed item was presented. After an incorrect response, no corrective feedback was delivered and the next trial was presented, which usually consisted of an easy task. Following this, a corrective prompt was delivered prior to repeating the last task that was failed. The corrective prompt consisted of a physical model of the correct response paired with a verbal model. This approach was compared to the more common approach of providing corrective feedback as a consequence immediately after an error occurred. Results of this study indicated that the antecedent prompt acted as an abolishing operation and reduced destructive behavior to zero.

In 2002, Romaniuk, Miltenberger, Conyers, Jenner, Jurgens, and Ringenberg assessed the effects of choice among tasks on problem behavior maintained by attention vs. escape. A functional analysis was conducted to assess whether problem behavior was maintained by escape or attention. Following the functional analysis, experimenters gave

students the chance to choose their own instructional tasks. Results demonstrated that students who displayed problem behavior maintained by escape had a substantial reduction in that behavior when they were given the opportunity to choose among tasks. However, students who displayed problem behavior maintained by attention did not exhibit any reduction in that behavior when given the opportunity to choose among tasks. This outcome suggests that future research on problem behavior maintained by escape from task demands should examine interventions that involve choice among tasks.

A related approach for reducing problem behavior maintained by negative reinforcement is combining interspersal and fading techniques. Kennedy (1994) examined the combination of interspersal and fading as antecedents to alter the stimulus control by task demands. A descriptive analysis was conducted which concluded that task demands served as an antecedent for problem behavior, and social comments were generally associated with increased levels of positive social affect. Following the descriptive analysis, high rates of social comments were emitted while gradually fading in task demands across sessions. Results demonstrated that problem behavior decreased to near zero rates while successfully reintroducing task demands. In addition, task demands no longer served as an antecedent for problem behavior.

Another antecedent approach to reduce problem behavior is functional communication training (FCT). FCT involves a two-step process. First, the target behavior is assessed in a functional analysis to identify the function. Second, the individual is taught to emit an alternative communicative behavior that produces the same consequence as the problem behavior (Hagopian, Kuhn, Long, & Rush, 2005). Researchers have used FCT to reduce problem behavior maintained by negative

reinforcement as well as positive reinforcement. Lalli, Casey, and Kates (1995) examined the effects of FCT to reduce escape-motivated problem behavior in three subjects. The FCT consisted of teaching subjects a verbal response in order to escape from a task. In subsequent phases, escape was contingent on the trained verbal response and the absence of the target behavior. Results indicated that FCT with extinction reduced rates of problem behavior.

Fisher, Piazza, Cataldo, Harrell, Jefferson, and Conner (1993) examined the use of FCT alone and combined with extinction and /or punishment to reduce problem behavior maintained by negative and positive reinforcement in four individuals. Two subjects engaged in problem behavior to escape demands, whereas the other two subjects engaged in problem behavior to gain access to tangible items. The first phase consisted of FCT alone. During this phase, subjects were allowed to engage in the target behavior and were reinforced with escape from demands or access to tangibles when they emitted the alternative communicative behavior. The second phase consisted of FCT with extinction. During this phase reinforcement was contingent on the absence of the target behavior, when subjects emitted the alternative communicative behavior. The third phase consisted of FCT paired with punishment. This phase was identical to the second phase, except punishment was contingent on the occurrence of the target behavior. Results demonstrated that FCT alone did not produce clinically significant reductions; however, the combination of FCT plus extinction and/or punishment produced the largest and most consistent reductions.

One challenge of employing FCT as a treatment is that reinforcement for appropriate communication may not always be immediate or in some circumstances,

possible. The majority of published studies on FCT have not included reinforcement schedule thinning for communication (Hagopian et al., 2005). Several methods have been used among the studies that have conducted schedule thinning for communication. Fisher et al. (1993) examined schedule thinning for communication by introducing delays to reinforcement. Hagopian, Fisher, Sullivan, Acquisto, and LeBlanc (1998) examined schedule thinning by demand fading, and Lalli et al. (1995) examined progressively longer signaled no-reinforcement periods using a multiple-schedule arrangement.

To expand research on FCT with schedule thinning, Hagopian et al. (2005) examined FCT with extinction and FCT with extinction and competing stimuli during schedule thinning to reduce problem behavior maintained by positive reinforcement. Three subjects were identified to have problem behaviors maintained by positive reinforcement in the form of attention (subject 1), preferred tangible items (subject 2), and physical attention (subject 3). All subjects were taught an appropriate alternative communicative response to obtain the reinforcer that maintained problem behavior using FCT alone. During FCT alone, reinforcement was delivered non-contingently. However during the second phase, FCT with extinction, the target behaviors were on extinction while the appropriate communication response produced 30 s of access to reinforcement (attention for subject 1, access to video games for subject 2, and verbal and physical attention for subject 3). The third phase involved FCT with extinction and competing stimuli. This condition was identical to FCT with extinction except that stimuli associated with the lowest rates of problem behavior were provided noncontingently and continuously. The final phase of the study consisted of schedule thinning. For all subjects, the schedule of reinforcement was thinned so that the delay between

communication and reinforcement increased. In other words, subjects were taught to wait, without engaging in the target behavior, after emitting the appropriate request. During the delay, the competing stimuli were provided noncontingently. Results indicated that FCT with extinction was effective and the provision of competing stimuli can enhance FCT during schedule thinning for communication.

As the above review demonstrates, antecedent interventions can have significant effects on various behaviors. However, much still needs to be done in the area of antecedent control. One area where very little research has been conducted is on the effects of antecedent interventions on target behaviors maintained by access to tangible items. Therefore, the purpose of this study is to teach tolerance for delay of reinforcement to reduce a tangibly motivated, low effort behavior through schedule thinning during FCT.

Method

Participant and Setting

The participant was a 10-year-old female diagnosed with autism. She was verbal but had limited functional communication. Often times she would scream to gain access to desired items, however the items did not always correspond with what she vocally requested. When asked, the participant communicated her needs and wants through her picture communication book. For this reason she was taught to request reinforcers by pointing, rather than vocally.

Sessions were conducted in the participant's classroom, which was located at a private school for children with autism and other developmental disabilities. The classroom included five other students, a lead teacher, and two assistants. All sessions

were conducted by the lead teacher. The participant and lead teacher were seated next to each other at the table.

Materials

Materials consisted of a card containing icons of items that the participant typically requested during a two-week informal preference assessment (Figure 1). Other materials included an audible timer, and a data sheet.

Response Definitions and Measurements

Assessment and treatment sessions occurred three to six times per day and lasted 10 consecutive minutes. Tantrums were defined as any occurrence of screaming or crying and/or vocalizations above normal conversation volume. Occurrence and nonoccurrence of tantrums were scored using a partial interval recording system during continuous 10 s intervals that were cued by an audible timer. The main dependent variable, percent occurrence of problem behavior, was computed by dividing the number of intervals in which problem behavior occurred by 60 and multiplying by 100.

Interobserver Agreement

A second individual recorded data with the primary observer during 38% of functional analysis sessions, 50% of baseline sessions, and 42% of treatment sessions. The primary and secondary recorded data independent of one another. Overall reliability percentages were calculated by dividing the number of agreements by agreements plus disagreements and multiplying by 100. For the functional analysis and baseline sessions, overall interobserver agreement was 97% (range, 87% to 100%). For treatment sessions, overall agreement averaged 94% (range, 80% to 100%).

Treatment Integrity

A treatment integrity checklist was created consisting of necessary preparations, required materials, and procedure steps. The checklist was completed by the primary or secondary observer during 66% of sessions and averaged 99% accurate implementation of experimental procedures.

Experimental Design

A functional analysis was conducted using a multielement design. The treatment analyses were conducted using a reversal ABAC design. The effects of thinning were evaluated using a reversal (brief probes of the terminal delay) design.

Phase 1: Functional Analysis

A naturalistic functional analysis was conducted in the student's classroom using 10-minute sessions. The participant was exposed to each of four different conditions in a random manner based on procedures described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994). Prior to sessions, all instructors were given a handout and training along with a video modeling of each condition. To increase the discriminability, each condition of the functional analysis was assigned a different color of shirt for the instructor to wear (Connors, Iwata, Kakng, Hanley, & Worsdell, 2000) and each condition was conducted by a specific instructor.

Condition 1: Demands. The instructor and participant sat facing one another at the participant's desk. The instructor presented the participant with her math program, which consisted of counting objects by forming sets. If the participant responded correctly by forming the correct amount of objects asked, the instructor provided social praise in a pleasant but neutral tone. If the participant responded incorrectly by forming

the incorrect amount of objects asked, the instructor provided a hand over hand correction procedure. If the participant engaged in the target behavior (at the initial scream/cry), the instructor removed materials, stood up and moved away to the opposite wall for 15 s.

The instructor immediately started the timer for 15 s and did not attempt to return to the desk until after 15 s, regardless of behavior. After 15 s, the instructor walked back over to the participant and represented work materials. If at any point prior to returning to the desk, the participant began to engage in the target behavior, the instructor walked away for 15 s and attempted to approach again. The instructor ignored all other behaviors. If the participant attempted to interact with other instructors in the classroom, they ignored.

Condition 2: Attention. Condition 2 was presented in the same manner as Condition 1, except that the participant sat without academic or other materials. The instructor did not attend to the participant and appeared to be doing paper work at the desk. If the participant engaged in the target behavior (at the initial scream/cry), the instructor attended to her and in a firm but neutral tone said, “Don’t do that”, or “Why are you doing that?” Once the instructor finished the statement, the instructor continued to ignore and resumed with “paperwork” at the desk. Each time the participant engaged in tantrum behavior social attention was provided. If the tantrum continued for longer than the statement, social attention was provided again after 15 s. This pattern continued every 15 s until the participant was quiet. Once she was quiet, the instructor ignored and provided social attention again at the next instance of the target behavior. Only the primary instructor delivered attention during this condition. Additional instructors did not attend to the participant if the participant attempted to interact with them. All instructors blocked the participant from accessing any items, including both preferred and

or non-preferred items. The instructor ignored all behaviors other than the target behavior.

Condition 3: Tangible. Condition 3 was the same as Condition 2, except that when the participant engaged in the target behavior (at the initial scream/cry) the instructor provided her with a preferred tangible item for 15 s. The preferred tangible was determined based on what she had requested to use during her table-based instruction 10 minutes prior to the session. After 15 s, with the preferred item, the instructor removed the tangible and resumed with “paperwork” at the desk. Each time the participant engaged in tantrum behavior she was provided with the preferred tangible. If the tantrum continued longer than 15 s with the preferred tangible, the instructor continued to allow the participant access to the preferred tangible until she was quiet. Once she was quiet, the instructor removed the item. The instructor provided the preferred tangible at the next instance of the target behavior. The instructor ignored all behaviors other than the target behavior and other classroom instructors ignored all attempts of the participant to interact during the session.

Condition 4: Control. Condition 4 was the same as Condition 1, except the participant was presented with preferred tangibles on the desk; and, no demands were placed on her. Preferred tangibles were determined based on what the participant had requested to use during her table-based instruction 10 minutes prior to the session. Social attention was provided on a fixed time 30 s schedule of reinforcement regardless of the participant’s behavior. When social attention was provided by the instructor, phrases were used such as, “That’s a pretty awesome toy you have”, “You look great playing with your toys,” or “I really like your toys.” Both target and non-target behaviors were

ignored and non-contingent social attention was provided every 30 s. All instructors ignored any attempts to interact during the session.

Phase 2: Treatment

Antecedent Procedure. Following the functional analysis, an intervention was designed to teach the participant a functionally appropriate alternative behavior (the FCT). The participant was then taught tolerance to delay because it is difficult to maintain a 0-second delay for a fixed ratio 1 schedule of reinforcement in the natural environment, so we wanted to teach her to tolerate delays to reinforcement. Prior to the intervention, a picture to object matching assessment was conducted. This assessment consisted of matching 20 pictures to their corresponding objects from a field of three. This ensured that the participant understood that the pictures represented objects. Each baseline and treatment session lasted for ten minutes.

Baseline. During baseline, the instructor provided IEP tabletop activities at the participant's desk. The activities were academic programs selected from the participant's IEP. A reinforcement schedule was in effect for correct responding during program work. Throughout the day, all requests for tangibles were honored and if a tantrum occurred during the request, the participant was prompted to request again using her communication book. Appropriate requests were honored even if tantrum behavior occurred.

Functional Communication Training (FCT). After establishing a baseline, training sessions were conducted to teach the participant to appropriately request a preferred item by using the card to point to the icon of the desired item. The instructor continued to present the participant with IEP tabletop activities, along with the card

containing icons of all her preferred items. When the participant pointed to a picture, the instructor gave the verbal cue, “you want the X” and allowed access to the item for 30 s. After 30 s, the instructor provided the verbal cue, “it’s time to do work” and removed the preferred item. The participant was given access to more than one item if appropriately requested during the 30 s. The instructor ensured the card was next to or carried by the participant at all times. Access to tangible items was provided on a Fixed Ratio 1 schedule, regardless of tantrum behavior. The instructor ignored the target behavior and continued to allow access.

Functional Communication Training with extinction (FCT w/ EXT). These sessions were identical to FCT, except the instructor did not grant access to the tangible during the occurrence of the target behavior. Tantrum behavior was on extinction while the appropriate communication response produced 30 s of access to the preferred tangible. If the participant engaged in tantrum behavior while using the card to point to a desired item, the instructor ignored the request and continued to work at the table. The tangible item was then delivered when the participant pointed to an icon of the desired item and was not engaged in tantrum behavior.

Schedule Thinning. The reinforcement schedule was thinned according to the predetermined schedule. This involved increasing the delay between an FCT response and the delivery of reinforcement. The delay was signaled by instructing the participant she needed to wait after appropriately requesting the desired tangible (i.e. “Okay you need to wait”).

Delays to reinforcement for communication were increased across eight steps with the following delay values: 1 s, 3 s, 6 s, 12 s, 20 s, 30 s, 40 s, and 1 min (the terminal

goal). To demonstrate experimental control, the terminal schedule (60 s) was probed after 6 s, 20 s, and 30 s. The criterion for advancing across steps was three consecutive sessions with 10% or lower tantrum behavior. The criterion to return to earlier steps was three consecutive sessions with 50% or higher tantrum behavior. The schedule-thinning procedure was pre-determined.

Results

Figure 2 depicts the results of the functional analysis. Tantrum behavior occurred at higher rates in the tangible condition ($M = 46\%$ of sessions) relative to the escape condition ($M = 16\%$), the attention condition ($M = 11\%$) and the control condition ($M = 0\%$). These results suggested that tantrum behavior was maintained by positive reinforcement in the form of access to tangibles.

Results of the treatment are depicted in Figure 3. High rates of tantrum behavior were observed during the initial baseline phase, with an average of 59%, ranging from 18% to 87%. With the introduction of FCT without extinction, tantrum behavior slightly decreased slightly relative to baseline, but remained variable with an average of 53%, ranging from 25% to 81%. Following a reversal to baseline tantrums slightly decreased to an average of 42%, ranging from 5% to 63%. The implementation of FCT with extinction resulted in greater reductions in tantrums than observed in FCT without extinction, with an average of 25%, ranging from 0% to 93%. During session twelve and for the remainder of the study, the participant began working at a computer desk so that when the computer was appropriately requested there was no delay in access to the tangible and the participant was not able to engage in tantrum behavior while walking to

the computer. This controlled for inadvertent reinforcement of tantrums. As a result, tantrum behavior increased to 93% followed by a significant decrease.

Delays to reinforcement were gradually increased up to 60 s, but levels of problem behavior did not remain consistently low. Following each increase in the delay to reinforcement, tantrum behavior initially increased followed by a decrease and each delay was achieved within 30 sessions. Three 60 s probes were conducted to determine whether it was necessary to increase the delay to reinforcement gradually, each resulting in an increase of tantrum behavior. The first probe occurred after the participant was taught to wait for 6 s, increasing tantrum behavior to 77%, the second probe occurred after the participant was taught to wait for 20 s, increasing tantrum behavior to 30%, and the final probe occurred after the participant was taught to wait for 30 s, increasing tantrum behavior to 45%.

Figure 4 demonstrates the average percent of intervals tantrum behavior occurred during each condition. During the initial baseline, tantrum averaged 59% of intervals. During FCT without extinction, tantrum averaged 53%. With the return to baseline, tantrum averaged 42% and with the introduction of FCT with extinction, tantrum averaged 25%. The three 1 min probes exhibited the highest percentages, averaging 77%, 30%, and 45%.

Discussion

Results of the current study suggest that schedule thinning is an effective antecedent intervention for teaching tolerance for delay of reinforcement. Gradually thinning the schedule of reinforcement, following an appropriate alternative response, increases tolerance during the delay and is associated with low levels of problem

behavior. The appropriate alternative response for communication was made to be low effort in order to compete with the low effort problem behavior. Therefore, by touching an icon that represents a preferred tangible, the participant is taught an appropriate alternative mand for tangibles (alternative to tantruming), while the timer and schedule thinning taught tolerance to delay of reinforcement. In addition, while the participant learns to wait a timer is provided to bridge the gap between an appropriate request and the reinforcer.

In the current study, the use of FCT addressed problem behavior maintained by positive reinforcement in the form of tangibles as well as escape tendencies. The participant was taught to request in order to gain access to a preferred item as well as escape demands. Although the participant was not taught an appropriate response to escape demands, while waiting for the requested item all demands are removed, therefore unintentionally teaching a method for escaping demands. Future research could address the effectiveness of FCT as an antecedent intervention to reduce problem behavior maintained by dual functions. Future research could also expand the results of the current study to include using multiple participants, teaching the participant to wait through completed trials rather than time, or expand findings on bridging the gap between a request and the reinforcer.

Although the results of this study are encouraging, a limitation is that the design of this study suggests schedule thinning is effective in teaching tolerance for delay of reinforcement, however does not support the effects of schedule thinning to increase communication skills. It was anticipated that conducting multiple probes of the terminal goal would demonstrate control, however the first data point of each delay was generally

high, therefore rather than gradually thinning the schedule results may have been the same if we began with the terminal goal (one-minute delay) and just exposed her to multiple sessions. In this case, her tantrums may have continued to decrease as they did in the each delay category. Further research on schedule thinning during FCT is needed to address its effectiveness in increasing communication skills.

Another limitation is no direct measurement is taken on the volume of the participant's voice. Therefore, it is difficult to determine a tantrum from speaking loudly. Often times the environment was very loud and caused the participant to speak louder. Without exact measurements on the volume of her voice, it can be difficult to determine a tantrum because at times she spoke borderline normal conversation volume, while displaying a positive affect.

Other limitations of the study include delaying data collection for 3-4 weeks during the second month of treatment due to weather conditions and a holiday break. After a substantial delay in data collection, more data points should have been collected in order to have stable responding before moving to the next phase. In addition, a student, which engaged in tantrum behavior and required physical activity, transitioned in the classroom during the last two weeks of treatment. The participant often times engaged in tantrum behavior at the onset of any physical activity. There is no way to isolate the data and therefore, data may have been even more greatly reduced without the new student.

A strength of the study is that the participant was able to quickly learn new items within the context. Each item on the card represented an item she asks for regularly, however during the beginning of treatment she only requested the computer. Therefore,

whenever she wanted to request a different item it only took one or two sessions for her to generalize the newly taught skill. This may have occurred because she is very sensitive to any changes in the schedule of reinforcement. Another major strength of the study is that it was carried out by classroom instructors. That is, the student's typical teachers were able to carry out this complex intervention meaning that this procedure has good feasibility.

When employing FCT an important challenge is generalizing to a natural environment. In a natural environment, it is difficult to arrange for the communication response to occur at rates that can be supported by the level of reinforcement. Failure to develop a sustainable schedule may disrupt communication and potentially lead to resurgence of problem behavior (Hagopian et al., 2005). The findings of the current study demonstrate that schedule thinning during FCT is effective in teaching tolerance to delay of reinforcement during a schedule sustainable within a school setting. However, additional research is needed to determine whether the effects obtained in this study would extend to the application of FCT and schedule thinning in the community setting.

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Figure Captions

Figure 1. Functional communication card containing icons of all the items the participant requested during the 2-week preference assessment.

Figure 2. Percent of intervals problem behavior occurred during the functional analysis.

Figure 3. Average percent of each condition problem behavior occurred

Figure 4. Percent of intervals problem behavior occurred during the treatment and schedule thinning.



Figure 1

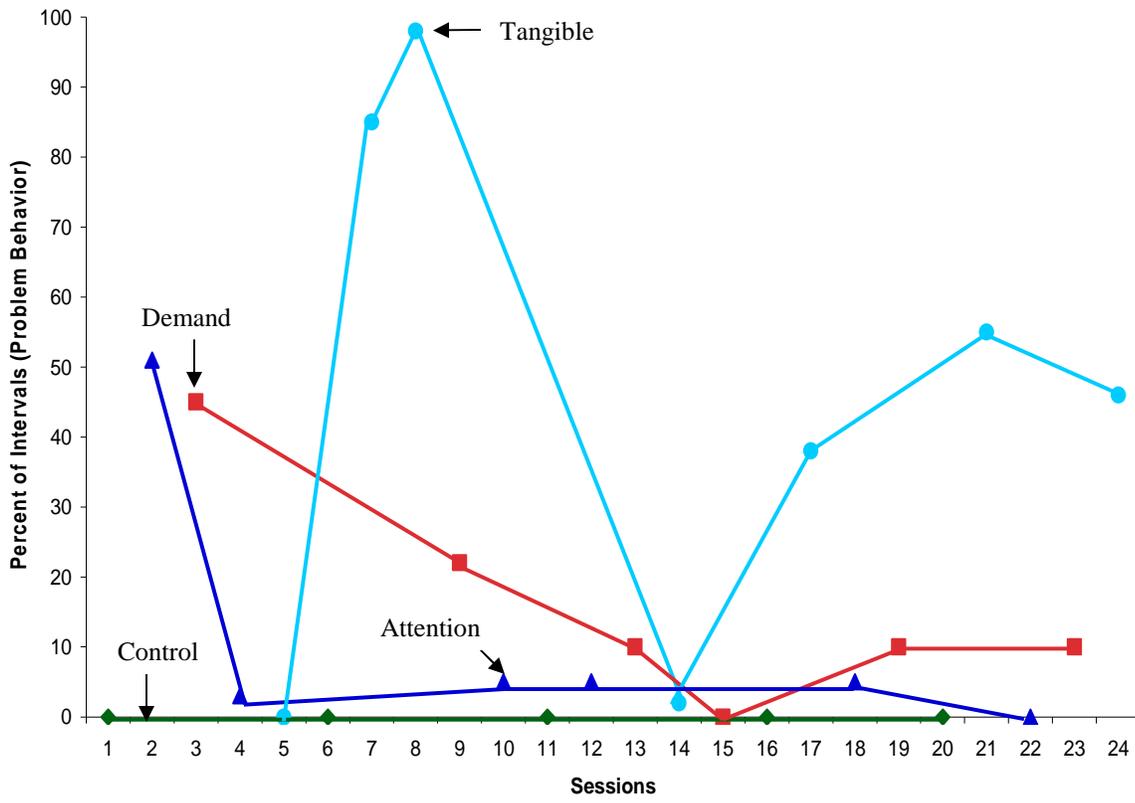


Figure 2

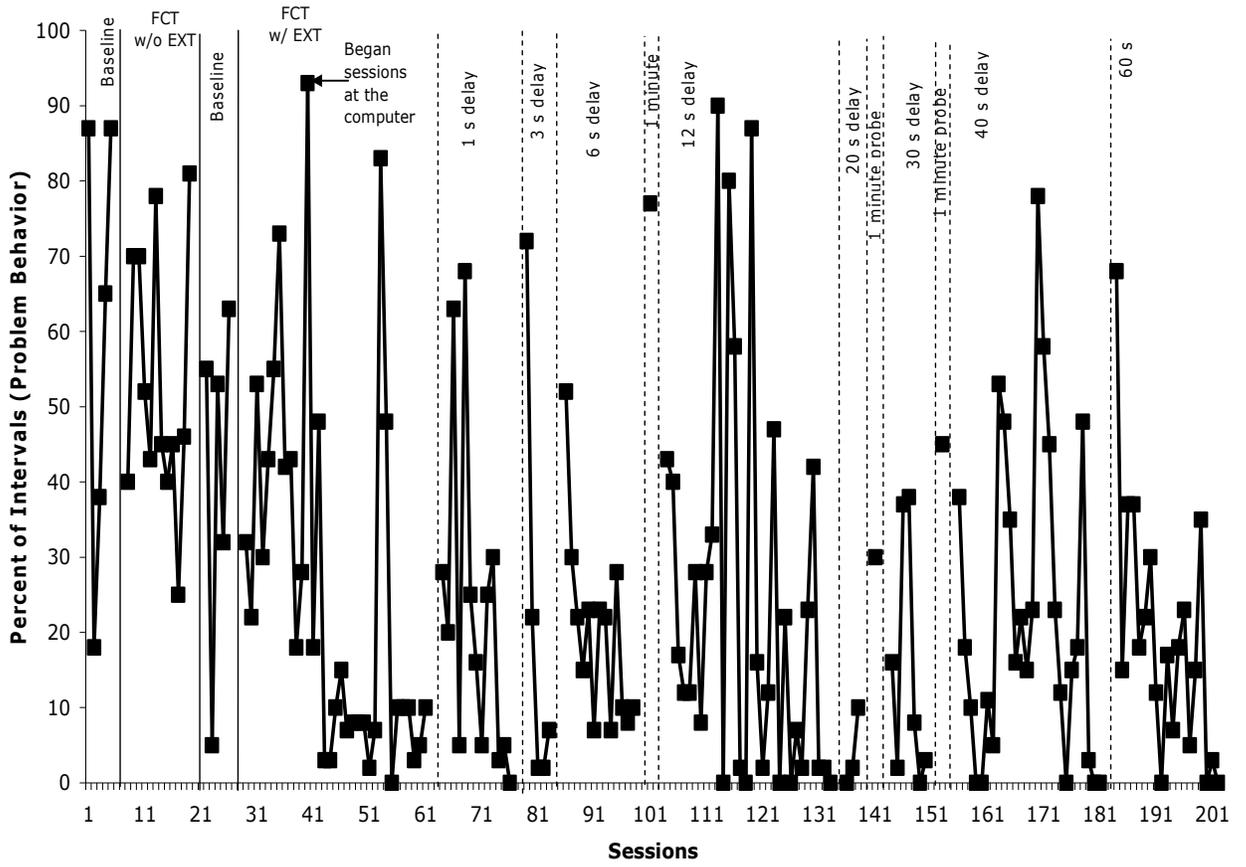


Figure 3

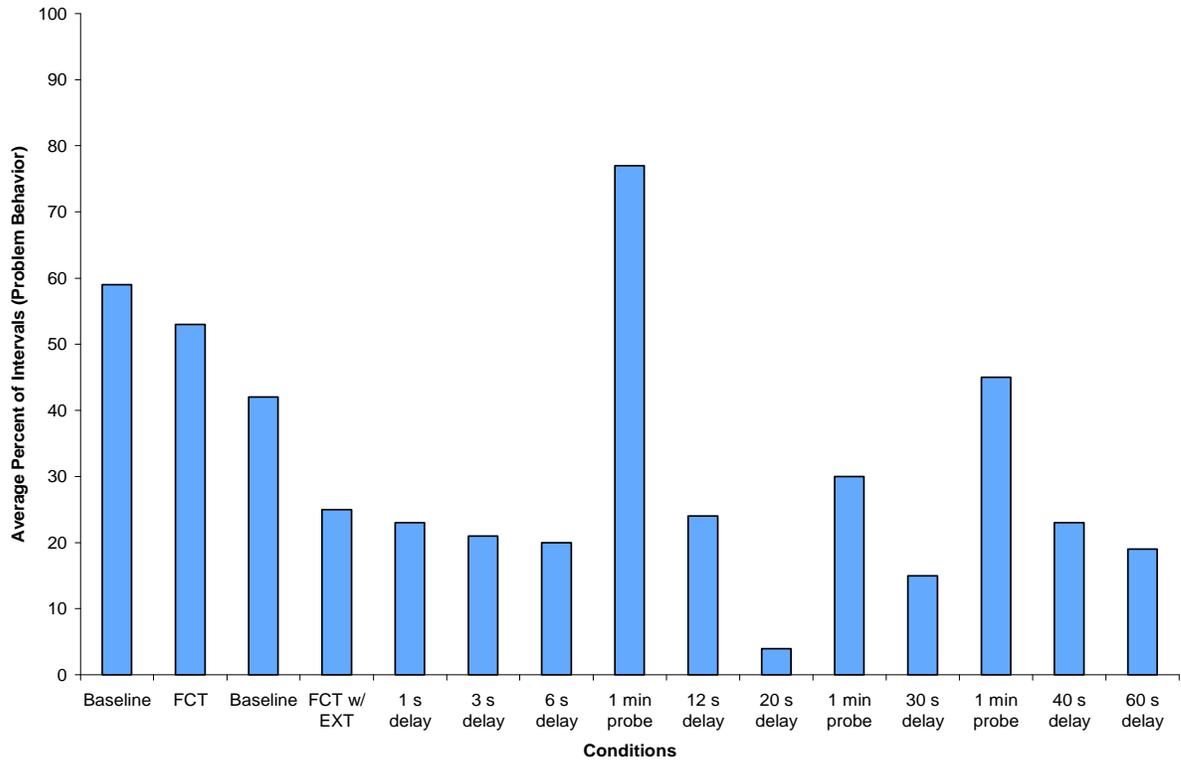


Figure 4