

## Assessing Self-Control Training in Children with Attention Deficit Hyperactivity Disorder

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### Abstract

This study examined the use of a progressive delay procedure with and without a concurrent activity to teach self-control to children with attention deficit hyperactivity disorder. Three participants were initially required to wait progressively longer periods of time for access to preferred edible reinforcers. After demonstrating this self-control, they were tasked by waiting for engagement in an activity identified as a preferred reinforcer. Results show that self-control training of these types could enable a person to delay gratification in a participant's typical environment.

**Keywords:** attention deficit hyperactivity disorder, delayed gratification, concurrent activity

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It is believed that 3 to 5% of children in the United States meet the current diagnostic criteria for attention deficit hyperactivity disorder (ADHD), making it one of the most prevalent disorders in the school-age population (American Psychiatric Association, 2000). A diagnosis of ADHD requires the person to display the disorder's symptoms before the age of 7 and impairments must be manifested in two or more settings (e.g., neighborhood, home, school). Additionally, diagnosed ADHD symptoms must cause significant impairments in academic, social, and occupational functioning, which are not better accounted for by any other disorder. Children and adults who have ADHD display certain degrees of overactivity, impulsivity, and inattention in various situations (Root and Resnick, 2003). Neef, Mace, and Shade (1993) operationally defined impulsivity in basic and applied behavioral research as choices between concurrently available response alternatives that produce smaller reinforcers rather than larger delayed reinforcers. Conversely, self-control is defined as choices that yield relatively greater gains at a later point in time.

ADHD, like other disruptive behavior disorders of childhood, is connected with low self-control skills (Strayhorn, 2002). Impulsivity is related to self-control deficiencies, which often involve a failure to think about the consequences of actions. Barkley (1997) suggests that children with ADHD tend to be less able to delay gratification and resist temptations and that the essential concern in ADHD is a deficit involving response inhibition. Neef et al. (2005) showed that the choices of children with ADHD are principally influenced by reinforcer immediacy and quality and least by rate and effort.

Previous studies that attempted to increase self-control focused on two types of interventions. The first involved interventions that progressively increased the delay to a larger reinforcer (Dixon & Holcomb, 2000). These authors presented a choice between an immediate smaller reinforcer and a larger delayed reinforcer to two groups of dually diagnosed adults. They showed that this progressive delay increased self-control among the participants.

The second type of intervention used to increase self-control extends the previous method of Dixon and Cummings (2001). It involves requiring the participant to be engaged in an activity during his or her wait time. Children were more successful in working for delayed rewards when they were asked to direct their attention away from the intervention (Strayhorn, 2002). Binder, Dixon, and Ghezzi (2000) suggested that the type of activity that the participants engage in was not critical to their ability to demonstrate self-control. The mere requirement of an intervening

activity is as effective in decreasing impulsivity as requiring a rule describing the contingencies. Neef et al. (2001) showed that a combination of progressive wait times and concurrent activities in increasing self-control can produce transfer across untrained reinforcer dimensions. However, they do not provide information on the generalizability of self-control trainings or the effects in the participants' typical environments. The purpose of the present study was to assess the self-control training procedures of progressive delays and progressive delays combined with a concurrent activity in the participants' typical environments.

## Method

### *Participants*

All participants were African American males residing in therapeutic foster care. Richard (11 years old) and Bob (10) lived in urban areas of Philadelphia, PA, while Vincent (14) resided in a suburban area just outside of Philadelphia. Richard took Straterra (40 mg/day) for hyperactivity. Vincent and Bob were medication free during the course of the study.

### *Settings*

All experimental sessions were conducted at the participants' homes or in a recreational area located directly outside the home. Background noise was not consistent during the study and the variations in ambient noise may have allowed for unaccounted variables to interfere with all participants' performance. During the natural baseline, choice baseline, and self-control training sessions, the participants were seated across the table from the experimenter in a section of their home that was separate from others. The generalization setting took place in a recreational area for playing football for Richard, and in area for playing basketball for Vincent. The generalization training for Bob took place in the same area where the other trials were conducted. All generalization settings remained consistent across participants throughout the study.

### *Research Design*

A multiple baseline across participants was used to determine any relationship between the applied experimental procedures and a subsequent increase in self-control. Initially, a natural baseline was collected to compare any later, potential functional relationship between the dependent and independent variables. A choice baseline was then collected to determine if the procedures resulted in increases in the target behavior. Self-control training was then introduced to increase the time waited for reinforcer gratification. Lastly, a generalization condition was conducted to determine if an increase in the target behavior generalized to the participants' natural settings.

### *Procedures*

#### *Natural Baseline.*

A stimulus preference test was conducted for each participant prior to implementing the procedures during the natural baseline segment. The participants' preferred reinforcers (edibles) were placed in full view on the table in front of them. The clinician asked the child, "Please wait as long as you can before eating \_\_\_\_." When the child stated that he could wait no longer, the clinician delivered the preferred reinforcer, and the session ended. Richard and Bob identified Snickers® chocolate bar as their preferred reinforcer. Bob identified Starbursts® as his. The dependent variable was the amount of time (seconds) waited for reinforcer gratification during each session. Natural baseline procedures remained in effect until the amount of time each

participant waited before requesting the item remained relatively stable.

#### *Choice Baseline.*

Each participant was asked to choose between his small immediate (one bite-size Snickers®/ Starburst®) and a large delayed reinforcer (two Snickers®/ Starbursts®). The session began “when the participant was instructed, “Do you want the [small item] now, or would you like [large item] after waiting a while?” The position of the reinforcers was alternated across sessions to control for position bias. If the participant chose the large item, the experimenter said, “Since you picked that one, you will need to wait for a while before I can give it to you.” The time requirement for access to the large delayed item was six times the participant’s natural baseline waiting time,” (Binder et al., 2000). Each session ended when the child selected the preferred reinforcer and consumed it, or fulfilled the delay requirement and consumed it. This segment ended when the participant selected the larger quantity of the two items offered and waited the required amount of time during four consecutive sessions.

#### *Self-Control Training.*

During each session, Vincent was asked, “Do you want [small item] now, or would you like [large item] in a little while?” If Vincent selected the small item, it was delivered immediately. If, however, he chose the larger item, then incremental delays increased every session at a rate of 6 seconds.

During each session, Richard and Bob were asked, “Do you want [small item] now, or would you like [large item] after we play a game?” All sessions were conducted individually for each participant. If the participant selected the small item, it was delivered immediately. If, however, the participant chose the larger item, then incremental delays along with a concurrent activity were imposed before the participant was allowed to consume it. The delays increased every session at a rate of 10 seconds for Richard and 3 seconds for Bob. The concurrent activity involved symmetry matching (pictures to their word equivalents). To ensure that the participant had adequate mastery of this activity, the clinician asked the two children to match pictures with their word equivalents. If the result were less than 75% successful matching on 3 consecutive trials, then the experimenter repeated this procedure with reflexive equivalence (matching picture to picture). This task was completed with 100% accuracy for Richard and 90% for Bob. During the experimental setting, the participants were given enough cards where they would not have enough time to successfully match them all. This was to ensure that they were engaged the entire time before having their waiting reinforced. This segment ended when the participant selected the larger quantity of the two items offered, fulfilled the requirements to delay gratification, for four consecutive sessions.

#### *Replication Setting.*

In a typical setting frequented by Vincent (basketball court), he was asked to choose between the small immediate (one shot of the basketball) and large delayed reinforcer (ten shots). This activity was identified as being reinforcing in his generalized setting. The session began when the experimenter asked, “Do you want one shot now, or would you like ten shots after waiting a little while?” If Vincent selected the immediate, shorter activity, it was delivered. If, however, he chose the longer activity, then incremental delays increased every session at a rate of 6 seconds. This segment ended when Vincent selected the longer activity and waited the necessary time during four consecutive sessions.

In a typical setting frequented by Richard (street outside of home), he was asked to choose between the small immediate (one throw and catch of the football) and large delayed reinforcer (ten throws and catches). This activity was identified as being reinforcing in his generalized setting. The session began when the experimenter asked, “Do you want one throw now, or would you like ten throws after we play a game?” If Richard selected the immediate, shorter activity, it was delivered. If, however, he chose the longer activity, then incremental delays along with the concurrent activity of matching pictures to their word equivalents, outlined in the self-control training, was imposed before Richard was permitted to play with the football. The delays increased every session at a rate of 6 seconds. This segment ended when Richard selected the longer activity and waited the necessary time during four consecutive sessions. In a typical setting frequented by Bob (play room in home), he was asked to choose between the small immediate (one minute of playing a hand-held video game) and large delayed reinforcer (six minutes of play). This activity was identified as being reinforcing in his generalized setting. The session began when the experimenter asked, “Do you want one minute of playing the video game now, or would you like six minutes after we play a game?” The video game played remained the same for all trials during this segment. If Bob selected the immediate, shorter activity, it was delivered. If, however, he chose the longer activity, then incremental delays along with the concurrent activity of matching pictures to their word equivalents was imposed before Bob was permitted to play with the video game. The delays increased every session at a rate of 3 seconds. This segment ended when Bob selected the longer activity and waited the necessary time during four consecutive sessions.

*Interobserver Agreement.*

A second observer was present on 25% of all sessions for the participants. Interobserver agreement was 100%. This was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying the sum by 100%.

Results and Discussion

Figure 1 shows the time waited for reinforcer gratification (in seconds) across natural baseline, choice baseline, self-control training, and generalization conditions for all three participants. The figure for increasing the incremental delay was arrived based on each participant’s relative natural baseline performance, the estimate being that the longer the participant initially waited, the greater their incremental delay.

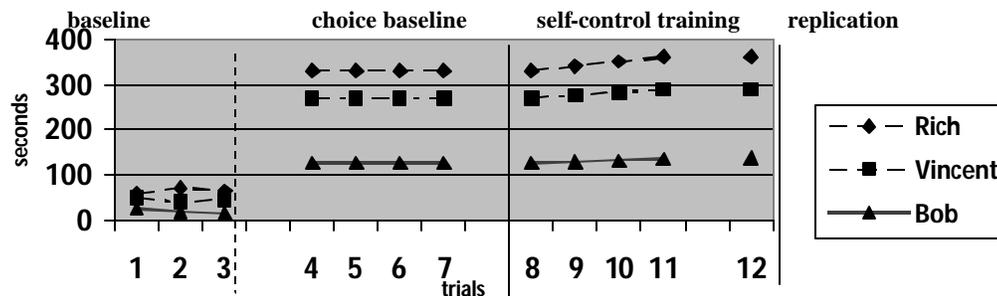


Figure 1  
Time waited for reinforcer gratification

Mean natural baseline for Richard was 65 seconds, 45 seconds for Vincent, and 21 seconds for

Bob. This resulted in a performance criterion of 330s, 270s, and 126s, respectively, during natural baseline and incremental delays of 10s, 6s, and 3s for each successful trial in the self-control training and generalization segments. All participants successfully completed all criteria by choosing to wait for the larger, delayed reinforcer, as opposed to selecting the smaller, immediate one.

The present results replicate the findings of Dixon et al. (1998) and Dixon and Holcomb (2000) who have shown that self-control, may be increased through progressive delays and participation in concurrent activities. However, before claim can be made, limitations to this study must be addressed.

### *Limitations and Future Research*

The research design incorporated in this study was an ABCD design. This design does not lend itself to any control for threats to internal validity. The arrangement of the experimental conditions does not allow for conclusions to be made regarding whether the self-control training resulted in the participant increasing his ability to wait for his reinforcer. Future applications could employ a multiple probe, multiple baseline design across participants, or reversal design to eliminate this threat.

As implemented, a comparison between natural baseline and choice baseline conditions may be prohibitive. The delay to reinforcer change cannot be compared because there is no choice to obtain a smaller/larger reinforcer in the natural baseline. Thus, the participant may have shown similar data had the natural baseline not been conducted. Future research could return to the natural baseline at the conclusion of the study, present the single choice again, and observe if now the participant could wait longer than previously for the reinforcer placed in front of him. This could allow for a decent measure of altered tolerance to delays.

While all participants had a diagnosis of ADHD, all chose the large delayed reinforcer four out of four consecutive trials prior to any self-control training. These results suggest that they may not have been initially impulsive prior to the study. Changes that occurred during the self-control training and generalization settings could be potential continuations of upward trends. Future research could be to conduct this type of training with participants (with a diagnosis of ADHD) who choose the small immediate reinforcer during the choice baseline rather than simply identifying participants with a diagnosis of ADHD.

The settings of the experiment remained constant but times were not. The establishment of operations may have varied with participants eating before the experiment on some trials but not others. The data suggest that this was not a factor, as participant performance was somewhat constant. Future research could account for these potentially contraindicating variables.

Richard and Bob were asked, "Do you want (number) minute of (preferred activity) now, or would you like (number) minutes after we play a game?" Using the word "game" may suggest a reinforcing activity to the participant and influenced his decision to delay gratification. The effect could have been seen if the participants (Richard and Bob) chose this option once or twice (delaying gratification) then resumed choosing the smaller, immediate reinforcer. This did not occur but was potentially possible and may have affected the participants' decision to delay or satisfy gratification.

Were the participants sufficiently tasked? While their natural baseline performance was stable, they progressed rapidly through the designated criteria to meet exit criteria. Future research may increase the time delay requirements more than this study's attempts.

Using similar methods, it is possible to investigate whether this type of training could generalize

the effects of self-control training. The replication condition gradually increased the delays to reinforcement from one self-control training to another. In order to investigate whether generalization has occurred, the previously trained behavior could be probed in a novel setting without having to be retrained. Future research could conduct choice baseline probes in the replication/generalization setting before, during, and after self-control training to obtain an assessment of generalization.

Although the generalized settings were typical for each participant, how effective would the training be in other, less controlled settings? It was reported that the all participants respond impulsively when verbally or physically assaulted by peers. Would the experiment's training generalize to those situations? Ethical considerations may prohibit experimental analyses of peer confrontations; however, future research may attempt to target concern areas of impulsivity for self-control training.

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