Using Functional Analysis and Conditioning Play Procedures to Increase Play and Decrease Stereotypy in a Student with Autism Spectrum Disorder

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Abstract

The present study used functional analysis and tested for the effects of a treatment package on the increase of play and decrease of stereotypy with a student with autism spectrum disorder (ASD) who attended an inclusive international school in Hong Kong. The treatment package was a partial replication of a toy conditioning procedure from Tsai & Greer (2006). The play used was games on an iPad. The functional analysis conducted suggested that the high rates of stereotypy observed were being maintained through automatic reinforcement. Furthermore, the student was chosen to be in this study due to his observed high rates of stereotypy and limited community of reinforcers. Results show a correlation between the play conditioning procedure and subsequent reduction in stereotypy.

Keywords

autism spectrum disorder, stereotypy, toy conditioning

Introduction

One of the defining features of children with autism spectrum disorder (ASD) and other types of special education needs (SEN), includes a lack of functional age-appropriate play. Without meaningful play behavior, children usually behave inappropriately and may be observed to have high rates of self-stimulatory behaviors known as stereotypy or passivity. Most early childhood assessment instruments that are used by professional behavior analysts to assess young children include multiple test items related to play (Bailey & Wolery, 1989; Partington, 2010).

The research literature in applied behavior analysis contains a variety of strategies and tactics found to remediate inappropriate play behaviors and decrease stereotypy that include punishment or conditioning reinforcement strategies. (Koegel, Firestone, Kramme, & Dunlap, 1974; Wahler & Fox, 1980; Greer, Becker, Saxe, & Mirabella, 1985; Nuzzolo-Gomez, Leonard, Ortiz, Rivera, & Greer, 2002).

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Koegel, Firestone, Kramme, & Dunlap (1974) provided one of the earliest applied studies on replacing self-stimulatory behaviors with play behaviors. The children were punished using vocal verbal reprimands such as "No" and were physically held to suppress or prevent the inappropriate self-stimulatory behaviors. Although the researchers were somewhat successful in replacing the stereotypy using punishment techniques, the play behaviors were not maintained nor were they generalized to multiple settings.

In an early study by Wahler & Fox (1980), four boys ranging in age from 5 to 8 years old were given a treatment package consisting of solitary toy play and time out from positive reinforcement. Improvements in play were observed, however, the effects were variable. In response to the variability observed in all four boys after exposure to the treatment condition, the researchers added the time out from positive reinforcement condition that functioned to reduce the variability of the students responding and improve the overall durability of the behavior change. In both Koegel, et al. (1974) and Wahler & Fox (1980), play behaviors were improved albeit the effects of their treatment packages were relatively weak and punishment was used.

In contrast, recent research suggests that strategies based on the principle of positive reinforcement such as conditioning reinforcement and observational learning techniques are preferred. These strategies may be more successful than punishment since they aim to replace undesirable behaviors (stereotypy and passivity) with more appropriate socially significant behaviors such as play and leisure skills without the common side effects that are common with punishment procedures (Cooper, Heron, & Heward, 2007; Nuzzolo-Gomez, Leonard, Ortiz, Rivera, & Greer, 2002) and include, self-management used to improve play in three children having SEN (Stahmer & Schreibman, 1992), video modeling used to teach reciprocal play skills (Dauphin, Kinney, & Stromer, 2004; MacDonald, Sacramone, Mansfield, Wiltz, & Ahearn, 2009), and increasing in toy play in toddlers having SEN (DiCarlo & Reid, 2004).

One of the earliest studies that used positive reinforcement with five adults with developmental disabilities, found that stereotypy could be reduced and effectively replaced through the implementation of a conditioning program that paired toy play with positive reinforcement (Greer, Becker, Saxe, & Mirabella, 1985). Their study was later successfully replicated by Nuzzolo-Gomez, Leonard, Ortiz, Rivera, & Greer (2002) using three preschool students with autism, extending the external validity of the findings to younger participants.

Singer-Dudek, Oblak, & Greer (2011) used a conditioning procedure that was successful in establishing books as reinforcers. These findings were educationally significant and could signal that a protocol can be used to induce verbal milestones lacking in students with SEN (Greer & Ross, 2008).

One study that focused on using a procedure to teach observational learning was by Leaf, Oppenheim-Leaf, Leaf, Courtemanche, Taubman, McEachin, Sheldon, & Sherman (2012). In their study, Leaf et. al. (2012) set out to replicate the findings of Bruzek & Thompson (2007) who found that typically developing preschool children's preference for playing with stimuli was increased after they observed a peer play with that same stimulus.

While typically developing children have a relatively wide community of reinforcers this is frequently lacking in students with SEN (Greer & McCorkle, 2003; Greer, 2002). Once conditioned, these new stimuli can provide the student with new motivation that will lead to success in school simply because they will have a

wider community of reinforcers that teachers can use to teach language (verbal behavior), social, and other academic responses (Skinner, 1957; Greer, 2002, Greer & Ross, 2008). To expand on this notion and the above-mentioned research base, Greenberg, Lau & Lau (2016) used an antecedent treatment package to replace stereotypy with painting as a form of appropriate play in four primary students with ASD. Painting can be done individually or in groups and can occur in a variety of settings that makes it an appropriate target behavior for almost all ages and may lead to the generalization of behavior change (Stokes & Baer, 1977).

In 2006, Tsai & Greer used an operant conditioning (pairing) procedure to condition books as reinforcers for four students with ASD. Their intervention involved 20 intensive rotations of train-test trials consisting of 5 seconds each. Their results show that the conditioning procedure resulted in fewer learn units needed for the students to master learning new sight words.

Our study aimed to test for the effects of the conditioning treatment package on the increase in play behavior and reduction of stereotypy behaviors as well as to extend the eternal validity of Tsai & Greer's (2006) treatment package on stereotypy behaviors with one student with ASD aged 13 using a single case experimental design.

Methods

Participants in the Study

A 13-year-old boy with moderate to severe ASD participated in our study. The participant was a student in an inclusive international school in Hong Kong. Student H received one-to-one special instruction with Applied Behavior Analysis (ABA) for 30 hours per week. He was recruited for this study due to his observed high rates of stereotypy.

Definition of Behaviors and Data Collection

Baseline Stereotypy and Post Treatment Stereotypy. Student H's stereotypy was observed and recorded during regular school days of virtual one-to-one sessions before and after the toy conditioning procedure. Stereotypy was defined as hand flapping, rocking, head shaking, non-sense vocalizations (*palilalia*), jumping, looking at lights with a side glance, mouthing fingers or inappropriate objects (*pica*), nose poking, and covering ears. Data were recorded using five-second partial time intervals and the Timer+ application on a smartphone was used to prompt the observers to record data.

Play Probes and Post Probe. Play probes were conducted during baseline of and after the play conditioning procedure to determine the level of appropriate play in free-play settings in a classroom. Appropriate play was defined as playing with and manipulating an iPad appropriately in the absence of stereotypy. All play probes were conducted in a free-play setting and were five-minute in length. A total of 60, 5-second intervals were conducted in each session. Intervals of appropriate play were recorded using a direct observation procedure.

Play Conditioning Procedure. The target behavior of the play conditioning procedure was appropriate play using an iPad during the test trials. An iPad was used in the play conditioning procedure as Student H had limited interest in toys, and iPad games was an age-appropriate toy for a 13-year old boy. Appropriate play was defined as looking at and/or playing with iPad games appropriately in the absence of stereotypy for the entire 5-second duration of the test trial interval. Each play conditioning session consisted of 20 pairs of train-test trials. Data were recorded using a whole interval recording procedure and direct

observation in real time. Data were recorded only during the test trials.

Procedure

A single case experimental design was used in this study and included the following conditions: functional analysis, baseline and post treatment stereotypy during virtual teaching sessions, and play-conditioning procedure (baseline play probes, train-test pairing of the play conditioning procedure, and post-conditioning play probes).

Functional analysis. The functional analysis consisted of direct observation and measurement of various environmental conditions such as attention, escape, and play (control) conditions (Vollmer, Marcus, Ringdahl, and Roane, 1995). Each session was 10-minute in length and all sessions were conducted by one of Student H's two ABA teachers. The experimenters were present for data collection and interobserver agreement measurements. The setting conditions were manipulated so that the participant would receive attention in the form of social praise, demands were stopped (learn units), or free play whereas the participant was allowed to play freely.

Baseline Stereotypy and Post Treatment Stereotypy (Virtual Sessions). Stereotypy was observed and recorded during one-to-one virtual sessions. Each session was 10 minutes in length.

Baseline Play and Post Probes. Each play probe session was five-minutes in length. During these probe sessions, various an iPad was placed on the table and the teacher instructed the student to "play."

Play Conditioning Procedure. The play conditioning procedure was a stimulus-stimulus pairing procedure. Each session consisted of 20, five-second train-test trial pairs. Each of the train-test trial pairs consisted of five seconds training of appropriate play with the iPad followed by five seconds of testing immediately after the training. Mastery criterion was established at 18/20 across two sessions.

Interobserver Agreement

In this study, IOA was assessed for 63% of the functional analysis sessions with a mean of 99% for attention condition, 97% for demand condition, and 99% for play (control) condition. IOA was assessed in 92% of the baseline & post treatment stereotypy of virtual sessions, 80% of the free-play probe sessions, and 100% of the play conditioning procedure sessions. The mean agreement was 96% for baseline & post treatment stereotypy of virtual , 88% of play probes, and 96% of the play conditioning procedure.

Results

Figure 1 shows the result of the functional analysis. Stereotypy was observed in all three conditions. The rate of stereotypy was highest in the play condition, followed by attention condition. The results suggested that the student's stereotypy might be maintained by automatic reinforcement and social reinforcement. Figure 2 shows the visual graphic display of the effects of the play conditioning procedure on stereotypy. In baseline sessions, the data showed an increasing trend of stereotypy with a mean of 65% of intervals. After the play conditioning procedure, the Student H showed a significant reduction of stereotypy with a mean of 30% of intervals. That is, the data showed that the student's stereotypy was significantly reduced (by more than half) during virtual one-to-one teaching sessions after the play conditioning procedure.

Figure 3 shows the play conditioning procedure including basslines, test/trial treatment condition, and post probe condition.

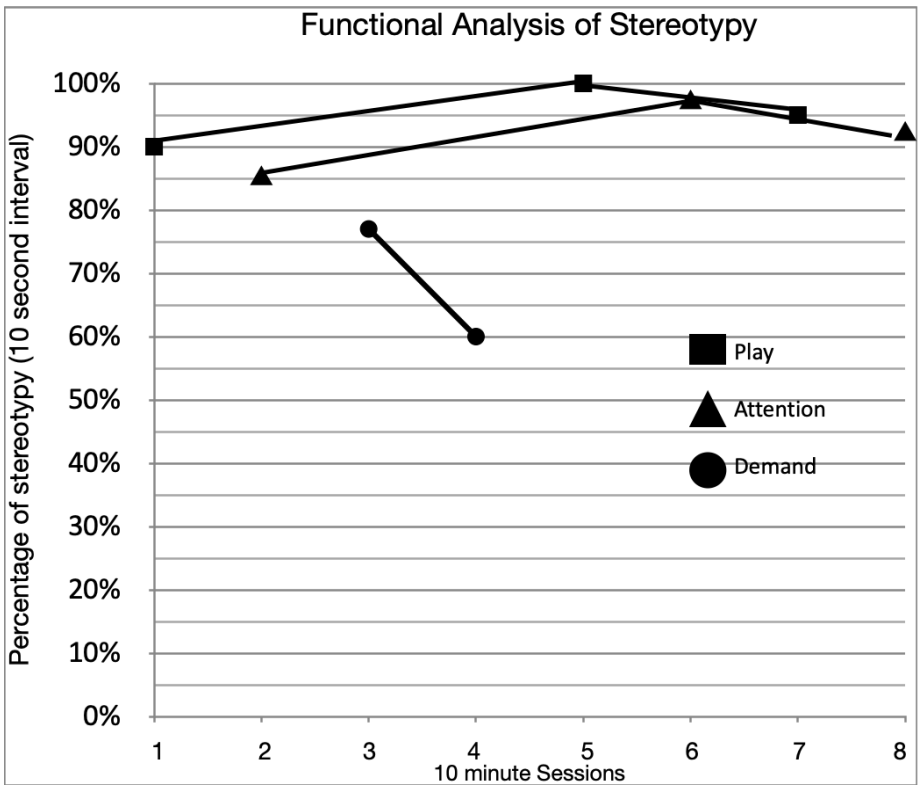

Figure 1. Functional analysis of stereotypy across three conditions: play, attention, and demand conditions

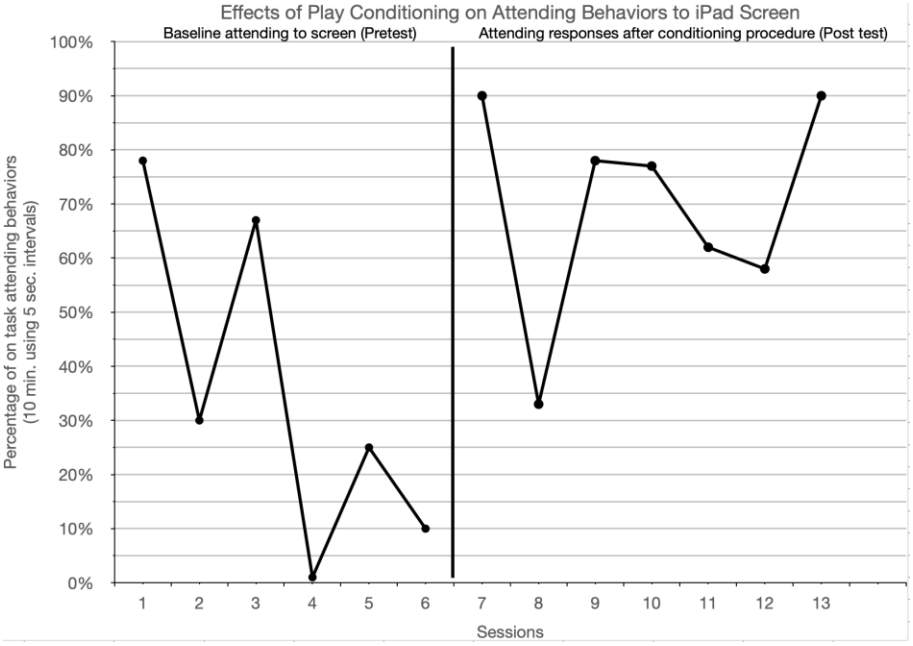

Figure 2. Effects of the play conditioning treatment data across pretest and posttest conditions.

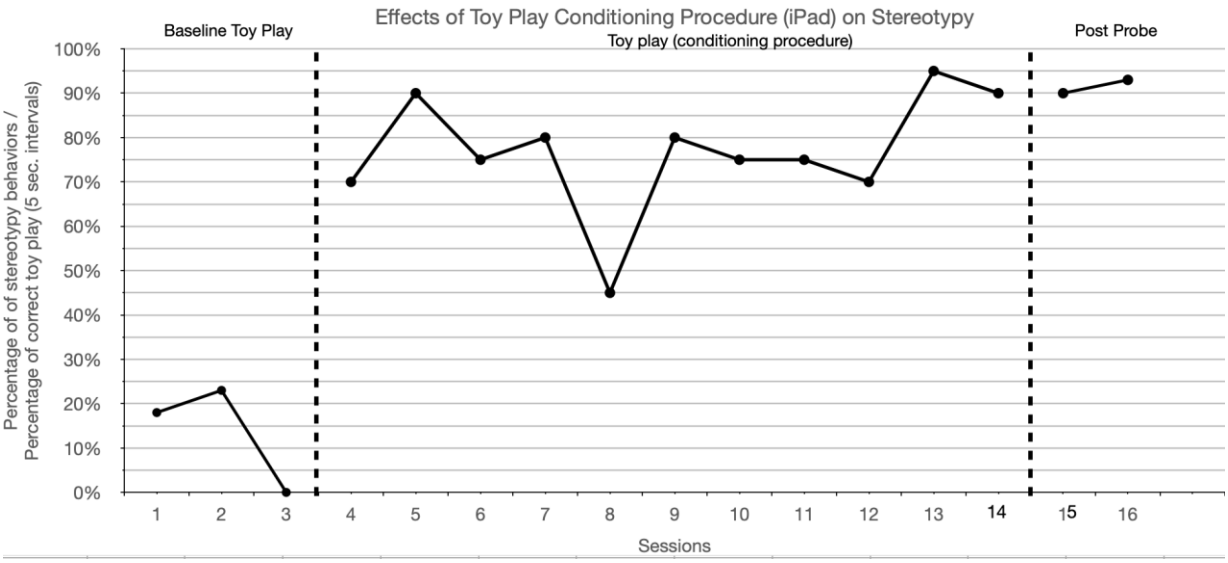

Figure 3. Toy play conditioning visual graphic display with Baseline, Toy Play Conditioning Procedure, and Post Probe experimental conditions.

Discussion

The data show that the treatment package (play conditioning procedure) consisting of 20 intensive rotations of train-test trials consisting of 5 seconds each was effective in decreasing the stereotypy behaviors. A correlation was observed between the implementation of the treatment package and the subsequently observed decrease in the number of intervals containing stereotypy for one student. An educationally significant reduction of 35% was observed.

Much like the books for the participants in Tsai & Greer's (2006) study, iPad games for our target student likely became a conditioned reinforcer as a function of the conditioning treatment package. Subsequently and simultaneously, Student H's stereotypy behavior was observed to decrease. iPad games are age appropriate for Student H and for mostly all teens and older children and young adults due to the variety of games and educational options that one can use across the lifespan.

Limitations of the Present Study

There were at least two limitations of the present study worth discussion. The first was that there was only one participant in the study. Second, during the intervention, there were a limited number of games presented during the train-test conditioning trials.

Implications for Future Research

Future research should test for the effectiveness of the toy conditioning procedure across multiple age groups of students and with students having different diagnoses. We showed that the play conditioning procedure can be effective in reducing stereotypy compared to Tsai & Greer (2006) findings of attending (observing) books.

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