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ORIGINAL PAPER

Effects of a Perseverative Interest-Based Token Economy on Challenging and On-Task Behavior in a Child with Autism

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Abstract We compared the effects of a token economy intervention that either did or did not include the perseverative interests of a 7-year-old boy with autism. An alternating treatment design revealed that the perseverative interest-based tokens were more effective at decreasing challenging behavior and increasing on-task behavior than tokens absent the perseverative interest during an early literacy activity. The beneficial effects were then replicated in the child's classroom. The results suggest that perseverative interest-based tokens might enhance the effectiveness of interventions based on token economies.

Keywords Autism · Perseverative interest · Token economy · Challenging behavior · Alternating treatment design

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Introduction

Token economy interventions involve delivering small tangibles (e.g., tokens) contingent on the presence or absence of target behaviors and then providing an opportunity to exchange a preset number of these tokens for backup reinforcers. Previous research has demonstrated that behaviors can be established, decreased, and/or maintained using token economy systems (Hackenberg 2009; Matson and Boisjoli 2009). Research has also investigated several variations of this intervention including the use of a response cost (i.e., losing tokens for inappropriate behavior), pairing tokens with praise, and delivering tokens on a variety of intermittent reinforcement schedules. These variables have been shown to influence the effectiveness of token economy interventions in some cases (Maggin et al. 2011; Matson and Boisjoli 2009; Mottram and Berger-Gross 2004).

One aspect of the token economy that has received relatively little attention is the token itself. Traditionally, tokens are considered to be neutral stimuli (e.g., tickets) that gain reinforcing power by being paired with the backup reinforcers. Charlop-Christy and Haymes (1998) investigated the effectiveness of incorporating the idiosyncratic perseverative interests of children with autism within tokens in an effort to increase the reinforcing power of the token. Charlop-Christy and Haymes (1998) defined such intense interests as preoccupations or obsessions that an individual continually seeks. Results from that study indicated that making use of tokens that reflected the child's perseverative interests (e.g., using a small picture of a train as a token for a child who had a perseverative interest in trains) improved intervention outcomes. To date, this appears to be the only study to have demonstrated the potential value of individualizing tokens based on a child's perseverative interest.

The purpose of this current study was to replicate and extend the work of Charlop-Christy and Haymes (1998). Specifically, we compared the effects of a token economy intervention that either did or did not make use of tokens that reflected a child's perseverative interest. We examined the effects of this manipulation on the challenging and on-task behavior of a 7-year-old boy with autism during an early literacy activity in a public school special education classroom and an inclusion classroom.

Method

Participant, Setting, and Materials

Troy was a 7-year-old boy who had been diagnosed with autism. He resided at home with his father, mother, and three older siblings and attended a local public school. He scored a 31 on the Childhood Autism Rating Scale (CARS; Schopler et al. 1980), which is indicative of mild-moderate autistic symptoms, and a 99 on the Behavior Assessment System for Children-II, which indicates an overall clinically significant range (BASC-II; Reynolds and Kamphaus 2004). Troy spent the majority of his school day in a special education life skills classroom with four to eight other

children with developmental disabilities, a special education teacher, and a teaching assistant. Troy's individualized education plan (IEP) called for him to spend 1 h of his school day included in activities with students without disabilities. However, Troy's challenging behavior (i.e., screaming, falling, and/or lying on the floor) occurred too frequently to be acceptable in an inclusion classroom (i.e., a classroom with a combination of students with and without disability).

The Questions About Behavior Function (QABF) Scale (Matson et al. 2012) suggested that Troy's challenging behavior was maintained by escape from demands. As a result, the inclusion time specified in his IEP was met by nonacademic activities with fewer demands (e.g., lunch, recess). Troy's school counselor referred him to this study in an effort to identify a strategy that could be used to increase Troy's inclusion during academic instruction in the general education classroom. Additionally, Troy had previous experience in using a traditional token economy within a discrete-trial format, and thus did not require additional training to use the token economy system for this study.

The baseline and intervention sessions were conducted in Troy's life skills classroom and in his inclusion classroom. A video camera on a tripod was used to record the participant and the researcher during all sessions. The inclusion classroom included one teacher, 14 students without disabilities, two students with learning disabilities who spent 100 % of their time in that classroom, and two students with developmental disabilities who divided their time between the inclusion and life skills classrooms. Both classrooms had a regularly scheduled early literacy activity, which lasted 10–12 min and occurred three or four times per week. During the activity, the teacher sat in a chair and read a story to the children as they sat on the carpet with a teacher assistant and researcher observing. The children were expected to sit quietly, look at the teacher or book, listen, and answer occasional reading comprehension questions.

Response Measurement and Interobserver Agreement

Data were collected on Troy's challenging behavior and on-task behavior. Challenging behavior was defined as screaming (i.e., loud vocalizations lasting 3 s or more that were considered disruptive in the classroom), falling, and/or lying on the ground (i.e., collapsing head and body to the ground). Screaming and falling often occurred in tandem, and the QABF suggested both were maintained by escape from demands, so these two topographies, whether they occurred alone or in combination, were recorded as challenging behavior. On-task behavior was defined as sitting with buttocks on the ground, head oriented toward the teacher, and having an absence of challenging behavior. Challenging behavior was scored using 10-s partial interval recording, and on-task behavior was scored using 10-s whole-interval recording (Kennedy 2005). The on-task behaviors were selected due to their incompatibility with Troy's challenging behavior; thus, challenging behavior and on-task behavior could not be scored in the same interval. Interval data were converted to a percentage by dividing the number of intervals with each dependent variable by the total number of intervals, then multiplying by 100 to convert into a percentage.

Data on interobserver agreement (IOA) were collected from videos for both dependent variables during 30 % of the baseline and intervention sessions by two trained independent coders. IOA was calculated by dividing the number of intervals with agreement (i.e., both data collectors scored the presence or absence of challenging behavior/on-task behavior for the interval) by the total number of intervals (i.e., agreements plus disagreements), then multiplying by 100 to convert into a percentage. Mean agreement for both dependent variables was 98.5 % (range 95–100 %).

Treatment integrity was assessed for 30 % of the sessions. A procedural checklist of intervention procedures (available upon request) was used to record the accuracy of intervention implementation. The mean of treatment integrity was 96.9 % (range 84.6–100 %).

Procedure

Research Design

The two token economy interventions (i.e., with and without embedded perseverative interests) were compared using alternating treatments with an initial baseline design (Gast 2010). The alternating treatments phase was conducted in the life skills classroom, and the intervention was implemented by the researcher. Generalization from the life skills classroom to the inclusion classroom was assessed by conducting a probe in the inclusion classroom during baseline and by adding a third phase, best-treatment phase, in which the intervention associated with less challenging behavior and more on-task behavior was implemented in the inclusion classroom (Gast 2010). Across all phases of the study, the following conditions were held constant: (a) session duration (10 min), (b) time of day when sessions were conducted, (c) the types of backup reinforcers that were available, (d) the number and timing of opportunities to exchange tokens for the backup reinforcers, and (e) the reading level of the stories. During the intervention and generalization phases, the reading activity was led by the classroom teacher. A teaching assistant was also present, and the researcher implemented the intervention.

Baseline

Four of the five baseline sessions were conducted in the life skills classroom. Due to high rates of challenging behavior, only one baseline session was conducted in the inclusion classroom. The duration of the reading activity was always between 10 and 12 min. To keep session duration constant, data were recorded during the first 10 min only. During baseline, all teachers and assistants were told to conduct the reading activity as they would normally. During baseline, the teachers in both classrooms verbally prompted on-task behavior (e.g., “Troy, please be quiet and sit up.”), provided praise contingent upon on-task behavior, and occasionally ignored challenging behavior or delivered a mild reprimand (e.g., “Troy, stop that.”). However, none of these components were consistently implemented, and despite this effort, the participant’s challenging behavior had persisted for over 6 months.

Preference and Backup Reinforcers

Backup reinforcers were selected by first asking Troy's teachers to identify potential reinforcers that would be appropriate in their classrooms. The teachers suggested small edibles (e.g., bite-sized candy or cracker) because they were inexpensive and could be consumed quickly without causing distraction. A pairwise preference assessment was then conducted to identify preference of bite-sized edibles (Fisher et al. 1992). Prior to each session, Troy selected a backup reinforcer from his top three preferences (i.e., M&M, fruit snack, and chip). The researcher reviewed on-task behaviors with Troy using a visual support that included pictures and words of targeted on-task behaviors (i.e., sitting down, staying quiet, and looking at the teacher) prior to the start of all sessions. The visual support remained present and was used to redirect challenging behavior if it occurred, at the end of each 20-s interval (i.e., the researcher pointed to the picture that represented the desired behavior instead of delivering a token) throughout each session.

Token Economy without Perseverative Interest

The token economy system that did not include Troy's perseverative interest used pennies with a small patch of Velcro® on the back that could be fastened to a token board. Penny tokens were delivered by the researcher sitting near Troy, contingent on 20-s of consecutive on-task behavior. A maximum of 30 tokens per 10 min session could be earned. Backup reinforcers (i.e., bite-sized candy) could be obtained for every 10 tokens earned, and an opportunity to exchange was presented within sessions at each moment in which Troy had earned 10 tokens. For data collection purposes, the exchanges were coded as on-task behavior. The token board included circles drawn in groups of 10 as a visual representation of the number of tokens needed to earn a backup reinforcer. Upon earning a token for targeted on-task behaviors, Troy was handed a token to place on the board (also coded as on-task).

Token Economy with Perseverative Interests

The token economy system used in this condition differed from the previously described condition in that the pennies and token board were replaced by tokens and a board related to Troy's perseverative interest in jigsaw puzzles. Specifically, the tokens were small foam puzzle pieces, and the token board was a thin cardstock frame into which the pieces fit. This token board mirrored the traditional token economy, in that it included 10 outlined locations for each puzzle piece. The same procedures, response requirements, exchange rate, and backup reinforcers were used in both token economy conditions (i.e., with and without perseverative interests). Troy's perseverative interest in puzzles was determined by interviews with teachers and a free operant preference assessment, in which a puzzle was made available alongside other toys and activity options (Roane et al. 1998). All of Troy's teachers agreed that he perseverated on a specific puzzle, and he devoted 100 % of his time in the free operant preference assessment touching, holding, and manipulating the

puzzle pieces. Further, Troy always selected this specific puzzle when other puzzles were available.

Generalization

Troy's behavior during the group reading activity in the inclusion classroom was measured in one baseline session using the same procedures as the other four baseline sessions conducted in the life skills classroom. In the final best-treatment phase of the study, three sessions were conducted in the inclusion classroom using the perseverative interest token economy system.

Results

The top panel of Fig. 1 displays the percentage of intervals during which Troy engaged in on-task behavior during the entire 10-s interval. During baseline, Troy was on-task in the life skills classroom for a mean of 11 % of the intervals (range 8–18 %). In the inclusion classroom, he was on-task during 13 % of the intervals. During the alternating treatment phase, both token economy interventions resulted in an increase in on-task behavior relative to baseline. However, Troy was on-task more often during the perseverative interest token economy condition ($M = 59.7$ %, range 48–70 %) than in the token economy condition that did not involve tokens reflecting his perseverative interest ($M = 45$ %, range 32–55 %). The increase in on-task behavior in the perseverative interest condition was then replicated during the final best-treatment phase in the inclusion classroom ($M = 64$ %, range 52–72 %).

The bottom panel of Fig. 1 displays the percentage of 10-s interval during which at least one instance of challenging behavior occurred. During baseline conditions in the life skills classroom, challenging behavior occurred during a mean of 89 % of intervals (range 82–92 %) and in 87 % of intervals in the inclusion classroom. Challenging behavior decreased from baseline levels in both token economy conditions; however, a lower percentage of intervals had challenging behavior in the perseverative interest condition ($M = 40$ %, range 30–52 %) compared with the condition where the token did not coincide with Troy's perseverative interests ($M = 55$ %, range 45–68 %). The reduction in challenging behavior in the perseverative interest condition in the life skills classroom was replicated during the final best-treatment phase in the inclusion classroom ($M = 36$ %, range 28–48 %).

Discussion

The results of this study replicate previous research demonstrating the utility of token economy interventions for children with autism (Matson and Boisjoli 2009) because both token economy interventions (i.e., with and without the perseverative interest) resulted in decreased challenging behavior and increased on-task behavior. Further, the superiority of the condition involving tokens reflecting Troy's

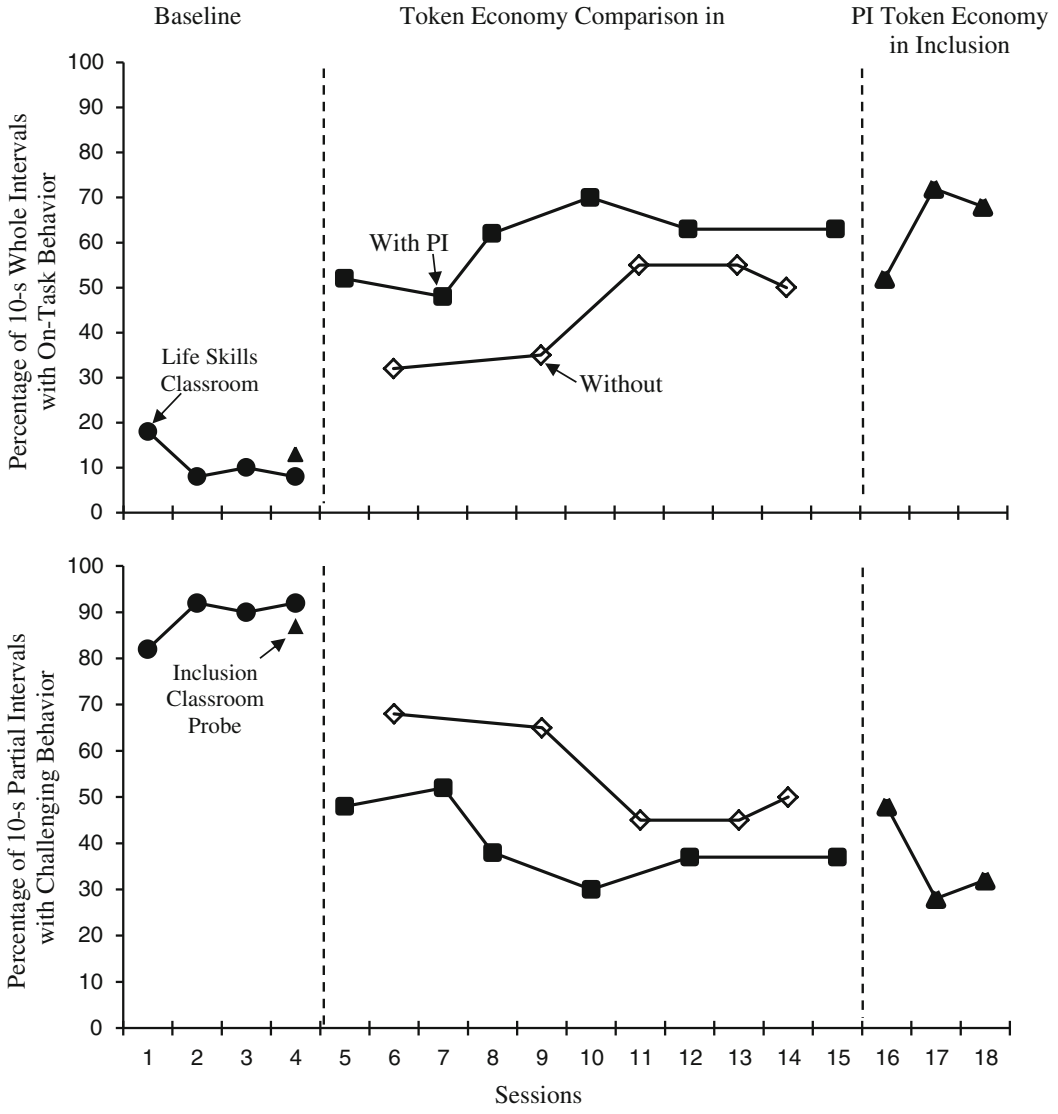

Fig. 1 The *top panel* displays the percentage of 10-s whole interval during which Troy was on-task, and the *bottom panel* displays the percentage of 10-s partial interval during which Troy engaged in challenging behavior. The *closed circles* represent baseline in the life skills classroom, *triangles* represent the inclusion classroom, *open diamonds* represent the token economy without the perseverative interest (PI), and *closed squares* represent the token economy with the PI

perseverative interest is consistent with the findings of Charlop-Christy and Haymes (1998). Finally, these data extend previous research by demonstrating the benefit of interest-based tokens in a special education classroom with generalization to an inclusion classroom.

The perseverative interests inherent to an autism spectrum disorder (ASD) diagnosis often impede appropriate classroom behavior and learning (e.g., Rispoli et al. 2011; Lang et al. 2010) and can be associated with serious challenging behavior (e.g., Hausman et al. 2009; Matson et al. 2009). Thus, interventions have primarily sought to address challenging behavior associated with such restricted and repetitive behaviors and interests (RRBI) with antecedent manipulations to enrich

the environment and prevent challenging behaviors, and consequence-based interventions that involve interrupting the repetitive behavior (see Boyd et al. 2012 for a recent review). However, other researchers have demonstrated the utility of capitalizing on perseverate interests by incorporating them into the intervention procedures or making access to RRBI contingent on targeted appropriate behavior or the absence of target challenging behavior (Baker et al. 1998; Charlop-Christy and Haymes 1996, 1998; Vismara and Lyons 2011). This study, considered in tandem with Charlop-Christy and Haymes (1998), suggests idiosyncratic perseverative interests can be utilized to improve intervention efficiency and effectiveness. The putative mechanism of action responsible for the enhanced effectiveness is likely the increased reinforcing value of the token itself. Compared with the use of neutral stimuli as tokens, the reinforcement from perseverative interest-based tokens may be more immediate, and thus more efficient, than relying only on the reinforcing power of the backup edibles that were available only after a number of tokens had been earned and exchanged. Although Troy was always willing to exchange 10 tokens for the backup reinforcers, it is possible that some children may value the perseverative interest-based tokens more than backup reinforcers. In such cases, challenging behavior maintained by continued access to preferred tangibles might be occasioned when the child is asked to exchange the high preferred token for a less preferred item. Practitioners using this approach are therefore cautioned to consider the reinforcing value of the perseverative interest token relative to the backup reinforcers. If challenging behavior is observed during the exchange, it may be preferable to use neutral stimuli as tokens or to merely use the preservative interest tokens alone without additional backup reinforcers. As part of a larger effort to better incorporate the characteristics of children with autism into intervention approaches with the goal of improving educational outcomes, future research designed to elucidate and then potentially address such a limitation remains warranted.

These findings buttress the evidence supporting the use of token economy systems with this population and align with the perspective that circumscribed interests can be a unique strength of individuals with high-functioning ASD (Mercier et al. 2000). Nevertheless, when children with ASD perseverate to the exclusion of other activities, such RRBIs significantly restrict their social and learning opportunities (Pierce and Courchesne 2001; Koegel et al. 1974; Lovaas et al. 1971). Research could continue to investigate the effects of embedding perseverative interests into other interventions, such as video modeling. However, it is possible that the use of perseverative interests in this way may inadvertently lead to a counterproductive increase in fascination with the perseverative interest. Although we are not aware of this issue having been reported in previous research, it would seem a plausible potential limitation that should be investigated as research in this area continues.

The results of this current study should be considered in light of a few limitations. First, we selected an alternating treatment design because teachers expressed concern regarding a reversal to baseline conditions. Although this design facilitated implementation in an applied setting, the lack of a reversal phase introduced the potential of carryover effects. Second, to identify Troy's perseverative interest, we

utilized teacher reports and a free operant preference assessment, which did not capture a hierarchy of reinforcers (Roane et al. 1998). Further, there is not a well-established procedure for distinguishing between high preferred stimuli and the level of fascination indicative of a true perseverative interest, and our assertion that puzzles were indeed a perseverative interest should be considered with caution. It is possible that puzzles were merely highly preferred. Future research should further investigate reinforcement hierarchies to determine more precise ways of identifying perseverative interests. Third, the visual cues utilized to prompt on-task behavior and redirect challenging behavior, although held constant in all intervention and generalization sessions, were not evaluated as a separate intervention component. Thus, we are uncertain to what degree they may have contributed to the effects on the dependent variables. Finally, because on-task behavior increased and challenging behavior decreased with the use of both token systems, assessing the value of the perseverative interest token proved difficult. It is possible that the effectiveness of both systems might approach equivalence over time if challenging behavior continued to decrease. Thus, future research should investigate the effects of extended use of the two systems, as well as the effects of systematic fading procedures of the embedded token system.

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