

Research Article

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The Effects of Token Reinforcement, in the Form of a Lottery, on Noncompliance in an Urban Third Grade Classroom



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Abstract

The purpose of this study was to examine the effects of token economy, in the form of a lottery system, on noncompliant behavior for a group of 10, 3rd grade students enrolled in a K-8th grade urban school. Sessions took place during a 30-minute guided reading lesson. This study implemented a daily lottery system where students earned tickets (i.e., tokens) on variable momentary time sampling-differential reinforcement of other behavior-150-second schedule (VMT-DRO 150-seconds). Tickets were awarded to students if behaviors other than noncompliant behavior were observed at the moment of the timed interval cue. At the conclusion of each intervention session, a random drawing of two lottery tickets were exchanged for preferred back-up reinforcers. Data were collected using a total count and a mean count per student of noncompliant behaviors per session. Data were graphed and analyzed using an ABAB single case design. The results show the lottery system intervention was effective in decreasing student's noncompliant behavior over the course of the study. The results also showed the decrease in noncompliant behavior during generalization probes conducted in a second school setting, and student's preference for the lottery as measure by a post-intervention social validity survey. Reinforcement probability and cost-effectiveness between a token and lottery system are discussed.

Keywords: Lottery; Token Economy; Token Reinforcement; Urban Education; Noncompliance; Elementary Education; Single Case Research.

Introduction

Noncompliance in the general education classroom setting interferes with all pedagogical practices, resulting in less academic time-on-task for both the student(s) engaging in noncompliant behavior, as well as any other students in the classroom. In such a situation, teachers confronting student noncompliance must implement both evidence-based strategies targeting academic and social skill learning, as well as evidence-based strategies targeting behavior management. One such evidence-based behavior management strategy is token economy, or token reinforcement system, a broadly research behavior change strategy that has been well established in both the experimental and applied fields [1,2].

A token reinforcement system defines an interconnected set of contingencies that specify the relations among (a) token-earning behavior, (b) tokens, (c) exchange opportunities, and (d) back-up (i.e., terminal) reinforcers [3,4]. Tokens may be manipulable objects (e.g. poker chips, tickets, coins) or non-manipulable objects (e.g., stickers/stamps on a page, marks on the chalkboard). Tokens are neutral stimuli that can be earned, accumulated, and exchanged for back-up reinforcers during scheduled exchange op

portunities. As such, tokens derive their value as conditioned reinforcers from repeated pairings with the back-up reinforcers for which they are exchanged [3]. Back-up reinforcers may be unconditioned reinforcers (e.g., food, water) or conditioned reinforcers (e.g., privileges, play opportunities, preferred tangibles). Applied research has shown that tokens can be established as reinforcers via instructions rather than direct experience with the pairing of back-up reinforcers. For example, Hackenberg [3] suggested verbal instructions might substitute for direct contact with the back-up reinforcer.

Researchers have shown token reinforcement systems have produced positive results across participant age level, participant disability type, and educational setting. Researchers have also shown token reinforcement systems were effective across both academic/on-task behaviors [5-8] and maladaptive/challenging behaviors [9,10]. In a recent meta-analysis, representing 90 participants in 28 single case research studies from 1980-2014, Soares, et al. [11] found that token economy was an overall effective strategy. More specifically, results showed (a) token economy as slightly more effective for participants between the ages of 6-15

than for participants between the ages of 3-5, (b) token economy was equally effective in general and special, education classroom settings, and (c) token economy was equally effective for both academic and behavioral outcomes [11]. As such, Jowett Hirst, et al. [5] suggested an advantage of token economy was that the system could be implemented as a general behavior management strategy during small and whole group instruction, increasing motivation for learning as well as, addressing minor classroom disruptions.

A variation of a token reinforcement system is a consequence-based lottery or raffle, where students earn tokens (e.g. tickets) that are entered into a drawing for the opportunity to obtain a back-up reinforcer [12,13]. Lotteries may be conceptualized as probabilistic reward systems [13] and/or probabilistic bonus contingencies [14], where the reward probability (i.e., odds of winning) may affect the target behavior. Wine, et al. [14] identify this reward probability as a potential variable that could affect the lottery effectiveness, although the authors suggest that various odds of winning are all effective. The purpose of this study was to examine the effects of a token reinforcement system, in the form

of a lottery, on the noncompliant behavior of 3rd grade students in an urban K-8th grade public school.

Materials and Method

Participants and Setting

The participants of this study were 10, 3rd grade students enrolled in an urban K-8th grade public charter school (Table 1). At the time of this study, 98% of the school’s population met eligibility criteria for the free and reduced lunch program. In addition, approximately 30% of the school population receives some level of special education services. The 10 students of this study were assigned to the same guided reading group because of similar scores on the Grey Oral Reading Tests (GORT) administered at the beginning of the school year. The GORT results showed all 10 students scoring in top three reading levels. All baseline and intervention sessions of this study were conducted in an enclosed space within the school library. The students sat on a carpet in a half circle while the teacher (first author) sat in a chair in the corner of the enclosed space. Generalization sessions were conducted at a table in the school hallway near the second-grade classrooms.

Table 1: Student Information.

Student	Gender	Grade	Birthdate	Age*	Native Language	Special Accommodations
1	F	3	June 23	8	English	None
2	F	3	Mar 2	8	English	None
3	F	3	Apr 15	8	English	None
4	M	3	Dec 17	7	English	None
5	M	3	Jan 16	8	English	None
6	M	3	Jan 29	8	English	None
7	M	3	Apr 12	8	English	None
7	F	3	Oct 19	7	English	None
9**	F	3	Sep 15	8	English	None
10	F	3	Feb 6	8	English	None

*Ages at the inset of the study.

**Student 9 left the study following session 16, and never returned.

Dependent Measure, Data Collection, Experimental Design

The dependent measure of the study was the total count of noncompliant behavior for the group of 10 students. Noncompliant behavior was defined as (a) vocalizing above normal conversational level without raising their hand or teacher permission, (b) eloping more than 10 feet from the designated area without adult permission or supervision, (c) dropping to the floor for longer than 5 consecutive seconds, (d) rolling their body from front to back and vis versa on the floor, (e) engaging with peers during independent work time, (f) taking books off shelves when not instructed, (g) refusing to begin or complete work, or (h) damaging personal/public property. A second dependent measure, the mean count of noncompliant behavior per student was also assessed because group absenteeism was reported during five of the session. From the original group of 10 students, two sessions reported one student absent (nine total students remained in the group) and three sessions reported two students absent (eight total students

remained in the group). During each 30-minute session all episodes of noncompliant behavior, as defined above, were counted using a manual handheld counter. The counter was out of sight of the students, typically in the pocket of the teacher.

A single case, ABAB design was used to evaluate the effectiveness of the lottery system (independent measure) on the frequency of non-compliant behaviors observed (dependent measure). Once a stable pattern of noncompliant behavior was observed during the initial baseline phase (A phase), intervention was introduced (B phase). Once change in non-compliant behavior was observed during the intervention phase (B phase), the baseline phase (A phase) was re-introduced. Once non-compliant behavior returned to performance levels similar to the first baseline phase during the second baseline phase (A phase), the intervention phase (B phase) was re-introduced [15]. A total of three experimental effects were recorded, noting the contrast in noncompliant behavior between (a) the first baseline phase and the first intervention phase, (b) the first intervention phase and the second

baseline phase, and lastly, between the second baseline phase and the second intervention phase [16].

Procedures

An informal preference assessment was conducted during the first week of school. During this preference assessment, students were asked what items they preferred and did not prefer. In addition, the 3rd grade classroom teachers were asked what items they used as rewarded in their classrooms. The information provided during the preference assessment was used to determine what preferred items would be made available during the intervention sessions. Preferred items serving as back-up reinforcers included play-doh, yo-yo's, gel pens, pencils, animal shaped erasers, notebooks, and other small school items. These back-up reinforcers rotated in and out of the prize box over the course of all intervention sessions to provide some level of reinforcer novelty.

Baseline

Baseline sessions started once all students arrived at the library and were seated on the carpet in a circle. Each baseline session began with the teacher reviewing general classroom expectations and procedures. Classroom expectations included (a) sitting with their legs folded and hands in their lap, (b) raising their hand if they had a question or comment, (c) remaining quiet when peers or teacher were talking, (d) staying in their spot given by the teacher, and (e) working quietly during independent or partner work. Once classroom expectations were announced, teacher explained the daily reading lesson, which typically included completing assigned readings and corresponding worksheets. Throughout the baseline session, if students were not following instructional directions, the teacher would redirect them back to the lesson (e.g. "Let's get back to reading the book"). General verbal praise was provided to any student displaying on-task, compliant behavior. At the end of the 30-minute session, the teacher asked the students to collect materials, turning in any assignments, and line up for dismissal to next class. Data collection ended once the last student exiting the library.

Intervention

Each intervention session began similar to baseline sessions; the teacher reviewed general classroom expectations and reading lesson procedures. Daily reading lessons were similar to lessons during baseline sessions, typically requiring completing assigned readings and corresponding worksheets. Unlike baseline, when students entered the circle, they each received an envelope with their name printed on it. During the intervention phase, prior to data collection, the teacher informed the students (a) how tickets could be earned by engaging in on-task behaviors (e.g., reading book without talking out of turn, following teacher directions, writing in notebook, remain seated in designated area) and not engaging in off-task behaviors (e.g. elopement, taking books off the shelves, damaging property, rolling around on the floor, vocalizations without raising hand), (b) how to place tickets into their envelopes when they received tickets, (c) where to place tickets and envelopes at the end of the 30-minute reading session, and

(d) how tickets would be drawn and exchanged for reinforcers. Students were not informed when the tickets were going to be distributed. Similar to baseline, if students were not following instructional directions, the teacher would redirect them back to the lesson (e.g. "Let's get back to reading the book"). General verbal praise was provided to any student displaying on-task, compliant behavior. Data collection ended once the last student exiting the library.

Using a cell phone interval tracker app, auditory cues were delivered on a variable momentary time sampling-differential reinforcement of other behavior schedule (VMT-DRO 150-seconds), where tickets were delivered contingent on the absence of non-compliant behavior (as defined in the above section) only at the end of each cued interval. Time intervals ranged from 75-seconds to 225-seconds in length. At the moment the auditory cue sounded, signally a time interval, students not engaging in non-compliant behavior received $\frac{1}{2}$ of a raffle ticket to put in their envelope (the other $\frac{1}{2}$ of the raffle ticket was placed in a container held by the teacher). All noncompliant behavior exhibited by any student at the time of the auditory cue was ignored. At the end of the 30-minute session, students took their tickets out of their envelopes while the teacher randomly selected two tickets from the container. Each number was read aloud, and the student with the corresponding raffle ticket exchanged their ticket for the back-up reinforcer in the prize box. Per request of their classroom teachers, any items selected were placed in their backpacks before ending the session and walking to their next class.

Each student had the opportunity to earn a maximum of 12 tickets per 30-minute session. When all 10 students were present, the group could earn a maximum of 120 tickets per 30-minute session. In general, if each of the 10 students earned the maximum 12 tickets per session, each students' odds of winning (probability) would be 1 in 10 (10%) during any given intervention session.

Generalization

Generalization data were collected for three sessions, (a) one session during the first intervention phase, (b) one session during the second baseline phase, and (c) one session during the return to intervention phase. The novel setting for generalization sessions was at a table in a hallway near both second-grade classrooms where small group instruction occurred. The students sat in chairs in a U shape, while the teacher sat in front of the students. The procedures during generalization sessions were identical to sessions conducted in the library setting. All rules and instructions during generalization sessions were also identical to sessions conducted in the library setting, with the exception of one new rule for generalization. Students were instructed to keep their voices below a normal conversation level while in the hallway because of proximity to other classrooms.

Inter-observer Agreement and Procedural Integrity

The teacher and a second independent observer collected inter-observer agreement data during 37% of the total session with an average of 93% agreement (range; 84% to 99% agreement).

Inter-observer agreement is the extent to which two independent observers agree on the occurrence of behavior for a given session. Inter-observer agreement was calculated by dividing the smaller number of occurrences by the larger number occurrences and multiplying by 100. Also, a second independent observer collected procedural integrity data during 50% of intervention session with fidelity at 100%. Procedural fidelity describes as how closely the session-by-session delivery of the lottery intervention matches the lottery’s written procedural steps. Procedural integrity data were collected using a checklist that had specific, systematic task analysis of the defined lottery intervention. Lottery intervention steps monitored included (a) tickets delivered according to the VMT-DRO 150-s schedule, (b) tickets and labeled envelopes present, (c) timer set, and (d) student placing earned tickets into envelopes. The second independent observer stood on the outside of the group with a view of all of the students, collecting both inter-observer agreement and procedural integrity data.

Results

When the study was completed, session data were analyzed as (a) mean count per student per session and (b) total count

per group per session. Mean count per student data were calculated because class-wide enrollment for five of the sessions was less than the ten students typically participating in the reading group. All sessions included ten students except sessions six (nine students), session 11 (nine students), sessions 16-18 (eight students).

Mean Count per Student and Total Count per Group of Noncompliant Behavior

The mean count per student for the first baseline phase was 18.64 (range 17.8 to 19). The mean count per student for the first intervention phase was 5.06 (range 3.8 to 8.2). The mean count per student for the second baseline phase was 17.8 (both sessions were 17.8). Lastly, the mean count per student for the return to intervention phase was 4.62 (range 2.62 to 7.25). Total count per group for the first baseline phase was 186.4 (range 179 to 190). Total count per group for the first intervention phase was 48.4 (range 35 to 74). Total count per group for the second baseline phase was 178 (both sessions were 178). Lastly, total count per group for the return to intervention phase was 37 (range 21 to 58).

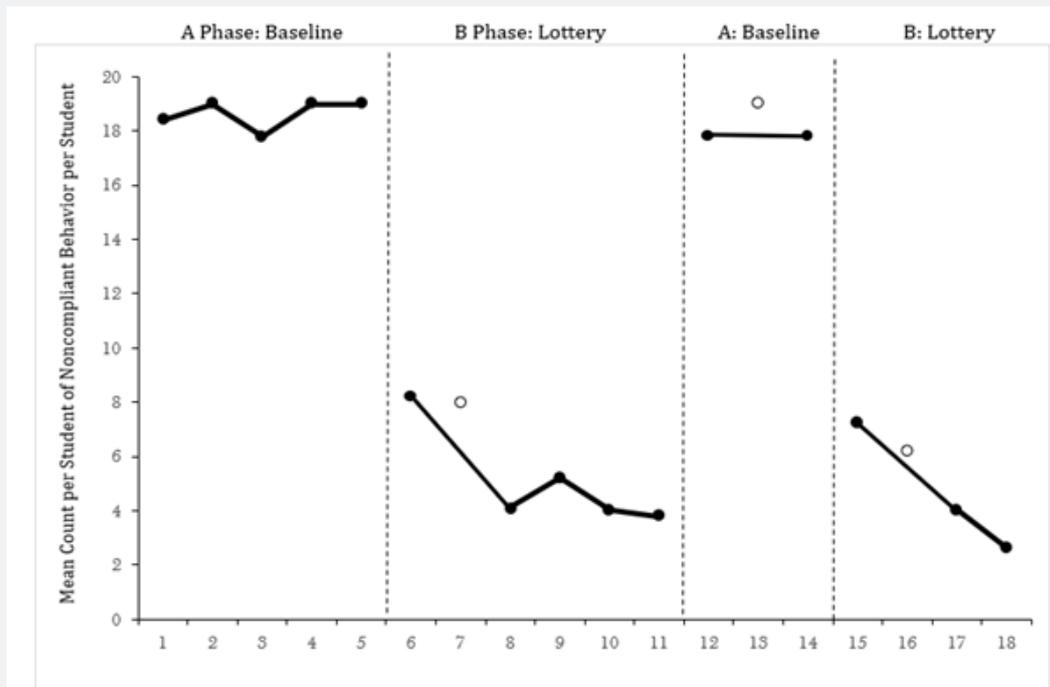


Figure 1: This shows the mean count of noncompliant behavior per student per session. The open circles represent generalization probes conducted in a second setting. One student left the study following session 16 and did not return.

Overall, visually analyzing both mean student and total group count of noncompliant behavior showed that the initial baseline data were stable across the first five session. The introduction of intervention showed an immediate drop in rate and count of non-compliant behavior, with an overall decelerating trend within this phase. A return to baseline showed an immediate change in level, with rate and count of noncompliant behavior returning to the initial baseline levels. A return to intervention showed an immediate

drop in rate and count of noncompliant behavior, with a decelerating trend within this phase (Figures 1 & 2).

Generalization

Generalization data were collected three time throughout the length of this study. The first generalization probe occurred during the first intervention phase (session 7), resulting in total count of 80 occurrences of noncompliant behavior, a rate of 8.0

occurrences per student per session. The second generalization probe occurred during the second baseline phase (session 13), resulting in a total count of 192 occurrences of noncompliant behavior; a rate of 19.0 occurrences per student per session. The last generalization probe occurred during the return to intervention phase (session 16), resulting in a decrease in the total count of noncompliant behaviors, at 62 occurrences, a rate of 6.2 occurrences per student per session. Generalization data collected during the intervention and return to intervention phase fell with-

in the range of session data collected during those intervention phases, while generalization data collected during the return to baseline phase were slightly higher than the range of session data collected during that baseline phase. This suggests the effects of the lottery system were effective in a setting other than the study setting. Anecdotally, one of the third-grade teachers reported that she noted a decrease in non-compliance behavior in one of the study students while he was her general education classroom.

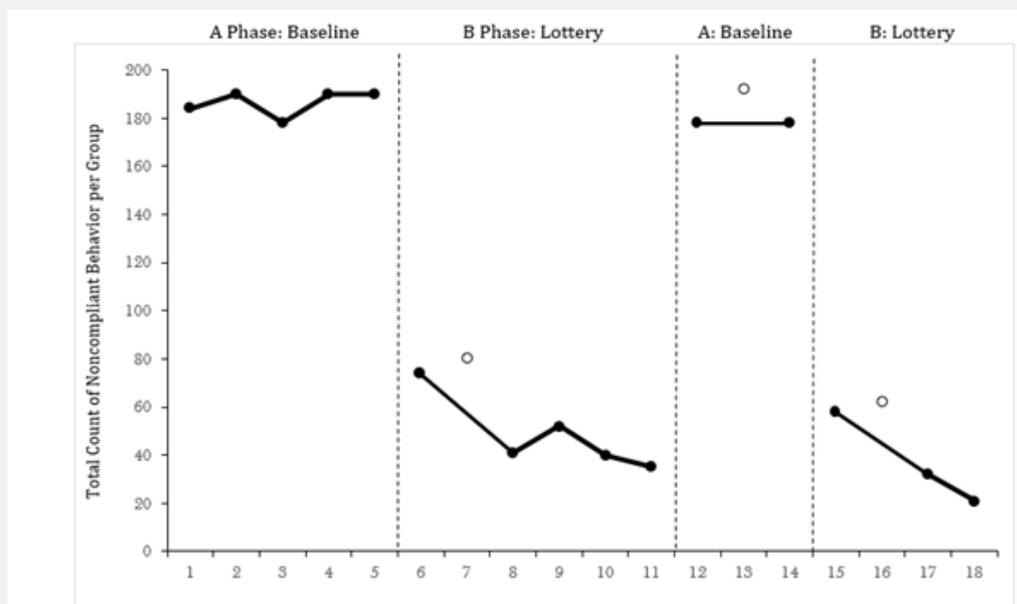


Figure 2: This shows the total count of noncompliant behavior per group per session. The open circles represent generalization probes conducted in a second setting. One student left the study following session 16 and did not return.

Social Validity

After the study was completed, we asked students to complete a social validity survey about the ticket system, using emoji to rate three questions. Figure 3 shows the total number of students circling that specific emoji for each of the three questions. The fourth question asked students if they had the opportunity to select at least one reinforcer from the prize bag. All nine students responded “yes” they did get to pick a prize from the prize bag. The fifth question asked students, in their own words, to explain if there were anything, they would change about the ticket system. Five students said nothing, while one student said they would change the color of the tickets. The final three students said they would have liked the prizes to include fidget spinners, putty/slime, and money.

Discussion

Token reinforcement, in the form of a group-wide lottery system was successful at decreasing noncompliant behaviors during the guided reading group sessions, supporting other previous research in that token economy or lottery systems can decrease problem behaviors [9,10,17]. Once implemented the lottery system resulted in reducing group-wide noncompliant behavior as

evident by the immediate reduction of noncompliant behavior on the first day the lottery system was implemented (Figures 1 & 2). In addition to the observed effectiveness, the lottery system presented here may reflect a more cost-effective alternative to token reinforcement. In our group-wide lottery system, two back-up reinforcers were delivered each session. In most token reinforcement systems, each student may earn a back-up reinforcer following each session [18-20].

Although data were not collected on the total number of tickets earned and entered into session lottery drawings, group performance did not fluctuate depending on the odds of winning. The win probability varied depending on each students’ own performance, as well as the performance of each student in the group. The probability of students ticket being drawn ranged from 100% (only one student earned tickets during the session, and that student’s ticket was drawn) to .9% (1/109; one student earned one ticket while the other 9 students earned the maximum 12 tickets, and the sole ticket of that one student was drawn).

Future research may consider student behavior in response to varying probabilities of reward by thinning the reinforcement schedule of tickets delivered. Thinning of the reinforcement sched-

ule may occur by increasing the time interval within each session. The current study followed a VMT-DRO 150-second schedule, where students could earn a maximum of 12 ticket per 30-minute session. A VMT-DRO 360-second schedule would deliver a maximum of five tickets per 30-minute session. Behavior maintained under a thinner schedule of reinforcement, would require less back-up reinforcers purchased, resulting in a more cost-effective classroom management system. Additionally, thinning the reinforcement schedule may occur by increasing the number of

sessions between lottery drawings. The current study drew lottery tickets following each session. Future research should plan for and implement a maintenance strategy where the exchange of tickets for back-up reinforcers occurs once every two or three days, then once a week on Friday afternoon. Again, increasing the temporal span between tickets earned and the exchange for back-up reinforcers would require less reinforcers purchased, reducing the overall cost for implementing the lottery system.

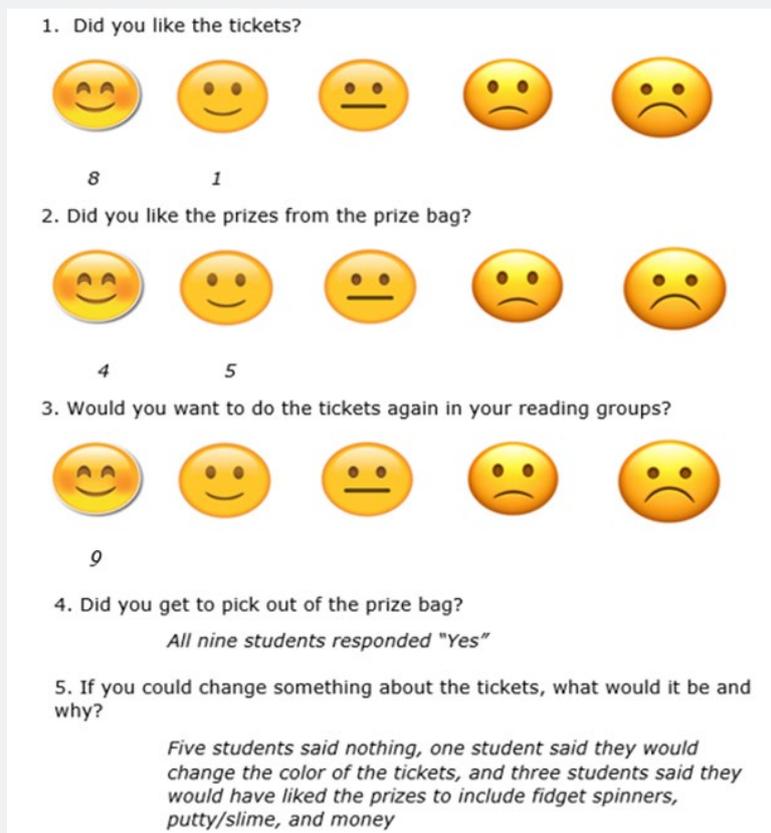


Figure 3: This shows results of the summary data of the 5-question social validity survey presented to the nine students at the end of the study. For questions 1-3, the number beneath each emoji represent the total number of students who circled that emoji while completing the survey. For questions 4-5, the summary of student responses is listed.

The VMT-DRO 150-second schedule used in this study monitored student compliant behavior at the time of the interval auditory cue only, and although we objectively defined and monitored student compliant behavior, we did not measure and graph that behavior session by session to note change in behavior levels. Future research should consider measuring and graphing student’s pro-social and/or academic behavior in addition to challenging behaviors such as noncompliance. For example, on-task engagement, academic task completion, academic task accuracy, class participation should be directly measured and graphed session by session, while measuring and graphing noncompliant behavior session by session. Lastly, future research should explore the role of this lottery system in a whole class, general education classroom.

One possible limitation for the study was attrition. Specific-

ally, one student left the reading group (and study) after session 15. Although this students’ absence did not seem to influence the level of non-compliant behavior when comparing the data pattern for those sessions in Figures 1 and 2, future research should monitor any attrition as that variable may influence group session data. A second limitation was the school calendar. As we completed session 18, the school quarter ended, resulting in new reading groups, thus disbanding our reading group. The limited time did not allow us the opportunity to conduct maintenance sessions post intervention, nor did the change in calendar allow us to thin the token reinforcement schedule from daily drawings to once a week drawing.

Conclusion

Student noncompliance occurs in many of today’s classroom. As student noncompliance increases, more instructional time is

now diverted to classroom management, resulting in less time on academic task. One widely used evidence-based practice is token reinforcement. Results of the lottery system intervention presented here showed group-wide effectiveness in decreasing noncompliant behavior. The lottery system intervention presented here also demonstrates a potentially more cost-effective token reinforcement variation. Results of this study showed student noncompliant behavior decreased quickly and maintained at low levels throughout both intervention and return to intervention phases. Results also showed the lottery intervention generalized to a second school setting, where student noncompliant behavior levels were similar to those recorded during the intervention phases. Lastly, results of the end of study social validity surveys showed students liked the tickets, the prizes, and would like to continue the lottery in new reading groups.

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