

*A TOKEN SYSTEM FOR A CLASS OF
UNDERACHIEVING HYPERACTIVE CHILDREN*

P. W. ROBINSON, T. J. NEWBY, AND S. L. GANZELL

BRIGHAM YOUNG UNIVERSITY

Using a BAB design, a token system requiring cooperative interaction was used to change the reading and vocabulary performance of an 18-member class of third-grade hyperactive boys. Four different colored tokens, which could be exchanged for 15 minutes of play on electrovideo games, were earned by successful completion of two tasks that involved learning to read and to use new vocabulary words in sentences, and two tasks in which the student served as a proctor to a student who had not yet completed those tasks. The mean number of tasks completed during the intervention periods rose to over nine times the number completed during reversal. Additionally, the average completion rate for the school district's standardized weekly reading level examinations rose from four to eight fold during the token conditions. All 18 students responded to the token program by increasing their academic performance.

DESCRIPTORS: hyperactivity, academic achievement, token economy, reinforcement, reading, children

Several approaches have been taken in an effort to improve the academic performance of disruptive and hyperactive individuals. Patterson, Jones, Whittier, and Wright (1965) improved the academically relevant response of attending to the teacher in a 10-yr-old boy using pennies and candy as reinforcement. The response of attending to the teacher was improved in five hyperactive boys, 6 to 9 yr old, using lights on desks as conditioned reinforcers with candy as back-up reinforcement (Quay, Sprague, Werry, & McQueen, 1967). In 1973, Drabman, Spitalnik, and O'Leary increased academic reading performance from 60 to 100% for eight third- and fourth-grade disruptive boys by teaching them self-control techniques in a special after school program using pennies, candies, and cakes as reinforcers. Academic behavior was also improved in three 4-yr-old hyperactive children through

self-instructional training (Bornstein & Quevilon, 1976). Ayllon, Layman, and Burke (1972) increased math and reading performance in four teenage hyperactive boys using a token economy with food and games as back-up reinforcers. Using an ABAB design, Ayllon and Roberts (1974) employed a point system with back-up reinforcers to increase the reading accuracy from 50 to 70% in five boys in the same fifth-grade class.

A cognitive training program involving modeling, self-verbalization, and self-reinforcement techniques was used (Douglas, Parry, Marton, & Garson, 1976) to train 18 hyperactive children to be more effective in dealing with academic problems. Boys ranging from 6 to 12 yr old were selected from various classes and given the training outside of class which significantly improved their academic performance.

Wolraich, Drummond, Salomon, O'Brian, and Savage (1978) selected 20, 6- to 10-yr-old hyperactive children from seven school districts and compared the ability of behavior modification and drug therapy to influence academic performances. Using a counterbalanced design, the

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20 children were placed in two different classes, with five children in each class on methylphenidate and five on a token economy system. Only the behavior modification program, however, significantly affected academic performance. These findings are in agreement with O'Leary (1980) as he pointed out that "Short-term effects on academic behavior have resulted from behavioral interventions but not from psychostimulants."

One dimension that is noticeably lacking in the literature is the demonstration that academic performance can be effectively improved with relatively large numbers of hyperactive children in the natural classroom setting. Being called upon to design a program for a class of 18 hyperactive children, the present authors were unable to find any published reports that successfully dealt with the academic performance of a large class of hyperactive children.

At the beginning of the school year a special third-grade reading class was formed in which 18 underachieving hyperactive children from the three existing third-grade classes were combined into a single class. In response to the request of the teacher, halfway through the school year, the authors consented to develop a special token system for the class. From the onset, specific restrictions were placed upon the project by the school district. For instance, whatever program was developed must not hinder the children being intermittently removed from class by resource teachers, as was required by the state for underachieving children. Weekly vocabulary testing for the children, which was required by the local school board, could also not be disrupted; and no program could be implemented unless it could eventually be run by a single teacher. And finally, indications of the program's success needed to be demonstrated within 4 wk, or permission for the program would be withdrawn.

The purpose of this investigation was to develop a token system to increase academic performance and which could be superimposed upon the existing classroom conditions, meet the

stipulations of the school district, and allow one teacher to effectively handle 18 hyperactive third-grade children.

To accomplish the task of having a system that required no outside help for the teacher, a token economy system was sought which used students in class to teach their classmates. No previously reported studies on hyperactive children have demonstrated the use of the students in the class to help teach each other. One of the characteristics that is often used to distinguish hyperactive children is their antisocial attitude and poor peer relationships (Clements, 1966; Conners, 1969; Laufer & Denhoff, 1957; Stewart, Pitts, Craig, & Dieruf, 1966). A requirement for success of the present token system was that hyperactive children could be induced to help each other.

METHOD

Participants

The participants were 18 third-grade boys identified by teachers and the school psychologists as hyperactive. Five students were on medication for hyperactivity. Examples of the diversity of problems encountered by the teacher are that one of her students was highly aggressive when left without medication but with its application became quite submissive, another student with a reading disability would read the word *saw* and pronounce *was*, and another diagnosed case of hyperactivity could not be medically treated because of treatment for allergies which would compound with any medication for hyperactivity.

Prior to this investigation, these 18 students had been together in the class from September to January. As an additional verification that the students placed in the class were hyperactive, a measure of out-of-seat behavior was taken in the classroom prior to the start of the token system to compare the hyperactive labeled class with the two other third-grade classes. The hyperactive class of 18 students averaged 13.6 students out of their seat every 30 sec while the other two

classes of over 30 students in each averaged 1.2 instances of being out of seat. Out-of-seat behavior was not used as a dependent variable measure during the main investigation because out-of-seat behavior was often functional in the token system used. Among other things the students were required to get their own files and assignments, get a classmate to proctor them, and leave their seat to be tested by the teacher.

The reading abilities of the hyperactive class ranged from low first-grade level to third-grade level. The students showed little or no cooperative play. Hitting, pencil throwing, chair throwing, shoving, and wandering around were the most common classroom activities of the children. During these months the teacher frequently called in sick to escape teaching the class. The principal could get no substitute to come a second time to take the class. Prior to the initiation of the project the teacher had told her principal she was quitting after the Christmas vacation because she could not handle her students. He asked her to stay on and seek professional help from the local university since the resident school psychologist could offer no solution.

Apparatus

One commercial pinball machine and two electronic "pong" games were used. The pinball machine was obtained from a vendor for \$300. The two electronic pong machines consisted of two TV screens in cocktail tabletype cabinets upon which up to four players could play an electronic version of tennis. These games were also purchased from a vendor for \$175 each. The metal legs of the pinball machine were removed so the machine could be placed on a low table adjusted to the height of the students. Metal edged, 4.31 cm diameter cardboard paper discs in four different colors (red, green, yellow, and white) were used as tokens. Each disc had a string attached which allowed the students to wear the tokens as bracelets. A 1 by 1.5 m feedback chart was posted on the class wall. Along the abscissa the student names were marked, while the ordinate of the histogram-type chart

indicated how many reading assignments had been completed. Different colored histogram columns were glued on the chart. Each color represented one of the five possible reading levels on which a student could be working (preprimer, primer, one, two, or three). When a student advanced to the next level, the appropriate colored column was then glued on the chart over the top of the previous colored column. There were also individual manila folders for each student in a filing cabinet in which the number of assignments completed by each student was recorded.

Procedure

Because the school worked with an open classroom format the teacher only had the hyperactive students as a class from 10:45 through 12:00 noon for reading and vocabulary assignments, and from 12:35 through 1:10 p.m. for silent reading. At other times they were mainstreamed in other classes. Originally the teacher wanted the authors to use a token program to stop the fighting and other out-of-seat behaviors by reinforcing the students for sitting down. Instead, an incompatible response approach (Allyon & Roberts, 1974) was used in which reading behaviors were reinforced, thereby reducing the time available for undesirable activities.

The school district used standardized reading and vocabulary assignments for all schools in the district. There were 220 vocabulary words that students in the district were to be able to read and understand by the end of the third grade. These 220 words represent 70% of the everyday vocabulary for the average person. They were divided into five levels or groups with from 40 to 45 words per level. The five levels were designated as preprimer, primer, level one, level two, and level three. Each student was tested weekly by the school's testing supervisor. The testing supervisor was a full-time employee of the school, whose job consisted of testing all students in the third, fourth, and fifth grades. He would take a group of four to five students from their class area to an adjacent section of the open classroom for testing. Each level was prerecorded

on cassette tape and consisted of listening to words given one at a time every 5 sec. The students were asked to identify those words given on the cassette from a list of similar looking or sounding words. To pass the level exam, no mistakes in identification were allowed. The cassette testing was an ongoing part of the curriculum before the present experiment was initiated. The investigators had no control over the makeup or administration of these weekly tests.

For the token program that was implemented during the morning session, the teacher was instructed to break each level down into 10 units. Each unit entailed having the student learn four new words, plus three review words. For example, if a student was learning Unit Six of Level One he would have to learn four new words, plus two review words from Unit Five that he had previously mastered, plus one randomly chosen review word from Unit Four of Level One. As part of the same unit the teacher had written sentences which included those seven words cut up so that a student had to arrange the words, including the seven unit words being learned, into four coherent sentences. Each sentence contained one or two of the unit words.

The procedure for completing the reading and vocabulary assignments with the token system was as follows: Student A would take out his file folder from the filing cabinet at the beginning of class. He would go to the unit assignment box, take out the unit he was to learn, study the words with the help of a classmate who had already learned that unit, go to be quizzed by the teacher who would give a green wrist token if he could repeat and write the words. Student A would then check the wall chart to see who had not yet learned that unit. He would then teach those same words to Student B who had yet to learn them. No specialized tutoring system was developed for the students. The teacher simply modeled the procedure by kneeling next to a student and helping him sound out the words. When constructing sentences with the words the teacher would say "that's right" or "that's wrong" when the student arranged the words.

If Student B then passed the teacher's quiz, Student B received a green wrist token while Student A received a yellow wrist token for helping Student B learn the list. The teacher would record in the student files and on the wall chart that each student had completed his particular part of a unit. The wall chart allowed the student to find someone to proctor them or to find someone to proctor without having to bother the teacher.

Student A would then pick out a packet containing cut up sentences to be rearranged, find a student to help him, be quizzed by the teacher, then receive a red token if he could correctly arrange the sentences for the teacher. A white token was earned when Student A then sat down and helped some other student learn to arrange correctly the sentences of that unit he just completed. When all four colored tokens had been earned, the student could immediately go and play on one of the pong machines for 15 min, where a game monitor would take the four tokens and start the machine. Every time a student completed one of the five major levels and passed the level test given by the testing supervisor, the student was allowed to play seven games on the pinball machine.

In summary, the basic program entailed having each student: (a) learn seven words of a unit, (b) help teach a second student those words, (c) learn to use the words in sentences, and (d) teach a second student to use the words in sentences. For the last student finishing each level, the teacher acted as the student to be taught. The teacher's role became that of watching over the whole class, keeping up the individual files and wall chart, testing the students, and rewriting class assignments into smaller units. The teacher would automatically test a student if her surveillance of the classroom suggested the student had not been studying the assignment. Attempts to deceive the teacher were almost nonexistent.

Design

To determine whether the system was effective under the stipulation of success in 4 wk a

BAB design was used. The token program was instituted for 14 school days, removed for 5 school days, then reinstituted for 13 school days during which time the graduate aid acting as game monitor was faded out of the program. The teacher eventually ran the program by herself with the help of students in class. The one stipulation the authors made of the school district was that a short reversal condition be allowed if there was success within the first few weeks.

The data collected from the class during the investigation were grouped together and two specific measures were focused upon: (a) the number of assignments the class completed (for each assignment the student earned one token), and (b) the number of vocabulary level tests mastered by the whole class.

When the reversal condition was started, the teacher told the students that Dr. Robinson had removed the machines, that she did not know why, and that there would be no more opportunities to play with them or to receive tokens for work done. The students were told that they should nonetheless continue to do the unit work. The feedback charts, the back-up reinforcers, and the colored tokens were all removed from the classroom during the reversal period. When the second B condition was begun, the teacher simply stated to the class that Dr. Robinson had consented to bring the machines back for the remainder of the school year. The school term lasted for 6 wk after the investigation was terminated.

RESULTS

The different conditions experienced by the class produced substantial changes in class achievement in terms of both measures. First, the class completed nine times as many assignments when working under the token system than when the token system was removed. The 18 member class, as shown in Figure 1, completed an average of 34.81 assignments per day during the 14 days of the first experimental stage (B). With the withdrawal of the tokens and back-up

Table 1
Summary of Analysis of Variance

Source	df	MS	F
Treatments	2	337.44	13.319*
Error	6	25.34	
Total	8		

* $p < .01$.

reinforcers during the reversal stage (A), the average number of assignments decreased to 3.8 completed per day for the whole class. Reinstatement of the token system raised the average rate of assignments completed to 39.57 per daily session. Conducting a statistical analysis over the last three sessions in each condition, as pointed out in Table 1, a significant difference was found to exist between the conditions. A further multiple group comparison test (Scheffé, 1959) showed significant differences between both the first experimental (B) condition and the reversal (A) condition (F -Scheffé = 21.369; $p < .05$), and between the reversal (A) condition and the second experimental (B) condition (F -Scheffé = 18.461; $p < .05$). There was no significant difference between the two experimental (B) conditions (F -Scheffé = 0.106; $p > .05$).

Figure 1 also shows that specific sessions during the experimental stages which produced a high amount of completed assignments were usually followed by sessions in which fewer assignments were finished. This "sawtooth" effect,

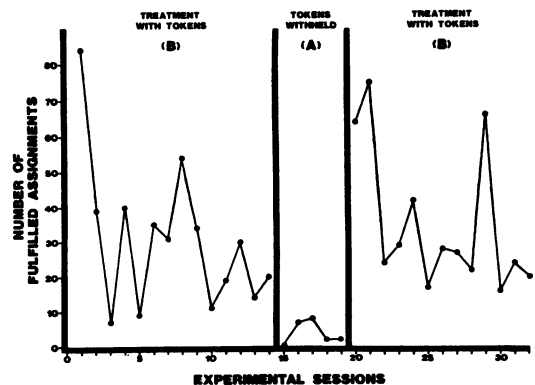


Fig. 1. Total number of completed assignments for an 18-member class of hyperactive students.

as seen in the two B conditions, was brought on by several factors. First, as it was previously designed, reinforcement was delivered immediately during class sessions and not during recess or after school. After a session in which several assignments were completed it was possible for the student to spend much of the next session "cashing in" his tokens playing games and spending very little time on assignment work. This accounts for the high rate of assignment completion during the first session of each B condition, as all students were working on assignments and few were playing games. Another factor was that this program was superimposed over the regular daily school schedule which often required several students at a time to leave the classroom for vocabulary testing or to attend a small class with a resource teacher. This led to a decreased number of students in the class working for tokens. The investigators had no control over when the students would be removed, for

how long, or how many would be gone at one time.

The reaction of particular individual students to the intervention of the token system can be seen in Figure 2. The students who completed the most assignments (C.D., J.C.) show their high amount of completion rates, with very few days of low productivity except during the reversal. On the other hand, R.B. and T.C., were the lowest producing students in the class. Both R.B. and T.C. spent several hours each week with the resource teachers because of their various learning disabilities. This school requirement made it necessary for them to miss at least part or several sessions during the token program.

The second means of measuring class achievement is shown in terms of whether the students were able to pass the standardized level tests required by the district. The school records show that for the first 5 mo of school (prior to the start of the token system) only 17 level tests

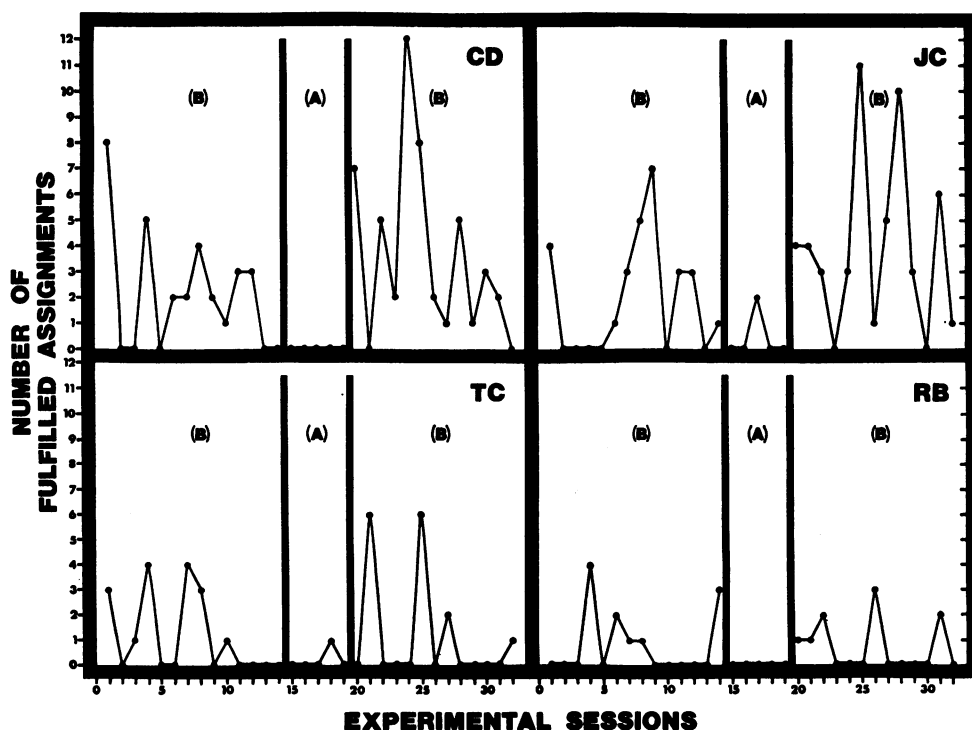


Fig. 2. Four individual students and the number of assignments they completed during the intervention and reversal periods. CD and JC recorded the most completed assignments for individual students in the class, whereas TC and RB recorded the fewest completed assignments.

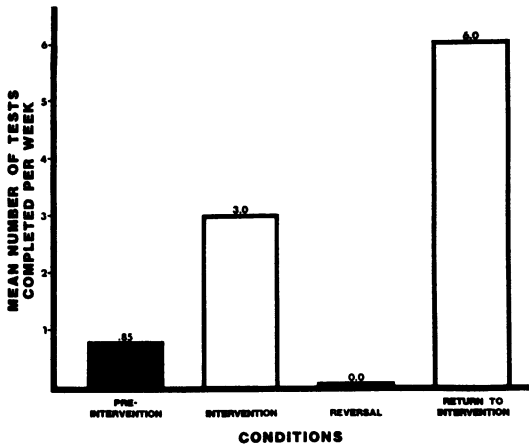


Fig. 3. Mean completion rate per week of reading level tests for an 18-member class of hyperactive students.

were mastered by the class of 18 students. As shown in Figure 3, this amounts to an average completion rate for the first 20 wk of school to be only .85 level tests passed each week. With the onset of the token system during the initial B condition, the rate of completion for the level tests rose nearly fourfold to an average of 3.0 per week. The reversal stage resulted in a period of no tests being mastered. Reinstatement of the token system brought a rise to 6.0 tests completed and mastered per week for the final stage of the experiment.

A closer look at what individual students achieved supports the data being presented in that manner. At the beginning of the investigation (and after the first 5 mo of school) two students were on preprimer, five were on primer, four were on Level One, one was on Level Three and six had completed Level Three. By the end of the study no students were on preprimer or primer, two were on Level One, one on Level Two, two on Level Three, and thirteen had completed Level Three. Seven of the thirteen who completed Level Three also mastered a special Level Four made up by the teacher so that students who finished Level Three could still continue on and earn tokens. The system ensured almost equal advancement throughout the class by requiring a student to help the one below him to

advance before he could receive all four tokens and go on to the next unit.

DISCUSSION

Several points stand out from this investigation. First, it is possible to use a token economy system to control academic performance in a large class of hyperactive children. The success of the system shows up not only on the students' increased completion of daily vocabulary assignments designed by the teacher, but also on the more standardized level tests used by the school district which the investigators or the teacher had no part in designing or administering. It is important to remember that these two measures, while concurrently employed, were not totally dependent. A student could master a level test without completing all 10 units covering the words in that level. He would then be placed on the next level unit. This is why it was possible for the class to master more levels (six per week) in the second B condition while averaging 39.57 tokens per day, when three level tests were averaged per week during the first B condition when 34.81 tokens were earned per day.

Second, the whole class of hyperactive students responded to dimensions of the token system in the same way as fewer numbers of hyperactive children had (e.g., Ayllon et al., 1972; Patterson et al., 1965) and classes of nonhyperactive students (O'Leary, Becker, Evans, & Saudargas, 1969; O'Leary & Drabman, 1971). The children responded quickly to the system as is evidenced in Figure 1 which shows that a substantial number of tokens were earned during the first day the system was in effect. The students also indicated that the tokens were a valuable part of the program as they frequently wore them on their wrists and showed them to their classmates. Blanchard and Johnson (1973) and Ayllon et al. (1972) have shown that hyperactive children would respond to a variety of tangible and activity oriented back-up reinforcers. After the present study was completed, the teacher began fading toward other reinforcers

(e.g., outings, time with teacher, popping balloons) and reported that her students continued to respond. Apparently a wide variety of reinforcers can influence academic performance in hyperactive children.

Third, hyperactive children of different achievement levels can respond to an incompatible response situation where academic performance is being rewarded. Ayllon and Roberts (1974) successfully decreased disruptive behavior in five fifth-grade boys by reinforcing academic performance. They suggested that their results might not be effective with underachieving children because all five of their subjects were good students in an affluent, upper middle-class public school. Twelve of the students in the present study were underachievers while six were working at the expected level for their age. All 18 students responded to the token system by improving their academic performance. Ayllon and Roberts (1974) also suggested that perhaps disruptive behaviors would have to be directly eliminated in underachieving students before academic performance could be increased. The present study successfully focused directly on reinforcing academic performance without prior reduction of disruptive behaviors. Although no specific contingencies were added to the token system to reduce disruptive behaviors directly, the use of the tokens had the same effect in this study as it had for Ayllon and Roberts (1974)—disruptive behaviors substantially decreased. No chair throwing occurred; and fighting and wandering were infrequent (approximately 20% of what it had been prior to the implementation of the token system as subjectively determined by the teacher and the authors).

Fourth, it is possible to design a token system for a class of hyperactive students that can be effectively controlled by one teacher using reinforcement contingencies to get the students to cooperate with each other in the learning process. The approach of using students to teach other students has been successful in the past with nonhyperactive classes (e.g., Dineen, Clark, & Risley, 1977; Surratt, Ulrich, & Hawkins,

1969). Although poor peer relationships and frequent aggressive actions are said to be attributes of hyperactive children, class cooperation can be obtained in a whole class of hyperactive children with effective reinforcement contingencies.

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