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EFFECTS OF GROUP CONTINGENT EVENTS UPON CLASSROOM NOISE[1]

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The first study investigated a group control procedure for suppression of excessive sound-intensity levels in a regular public school classroom. Reinforcement consisted of a 2-min addition to the class gym period and a 2-min break after maintenance of an unbroken 10-min quiet period as monitored on a decibel meter. Transgressions of the sound limit (42 decibels) resulted in a delay of reinforcement by the resetting of the timer to the full 10-min interval. The results indicated that these procedures were highly effective in suppression and control of sound intensities. The second experiment utilized a similar procedure coupled with a procedure of eliminating out-of-seat behavior. Experiment III studied the effects of Exp. II procedures on a single student's out-of-seat behavior rate. All procedures were found effective.

A number of studies clearly indicate that the systematic application of operant conditioning techniques has been highly effective in modifying a variety of behavioral problems (Ullmann and Krasner, 1965; Krasner and Ullmann, 1965; Ulrich, Stachnik, and Mabry, 1966). Thus far, the application of these techniques has been used primarily within special educational settings and with individuals rather than groups. The present study investigated the utilization of operant principles in a regular public school classroom using the combined behavior of a group of persons as the dependent variable.

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EXPERIMENT I: Control of Pupil-Produced Noise

The first experiment investigated a group control procedure designed to suppress excessive classroom sound. The class was allowed a 2-min addition to the gym period and a 2-min break contingent upon maintaining an unbroken 10-min quiet period as monitored on a decibel meter. Direct contingencies were not placed on other classroom behaviors.

METHOD

Subjects

A class of 29 fourth-grade elementary students, 14 boys and 15 girls, was selected because of excessive noise during their free-study period. This was a regular public school class with most of the children coming from lower-middle- and middle-class backgrounds.

Apparatus

The experiment was conducted in a typical classroom equipped with desks and facilities for 29 students. A General Radio Corporation model 710-A sound-level meter was used to measure the sound intensities during all phases of the experiment. An SRA electric timer with a buzzer was used to signal the time periods. A whistle was used as a signal to the pupils when they had exceeded the sound intensity limits. A stopwatch attached to the clipboard, which held the data sheets, indi-

cated the time intervals used in recording the data.

Observation Procedures

The basic data for the study consisted of the decibel (db) readings from the dial of the sound-level meter. The observer recorded the data from a position in the rear center of the room. Recording was done on sheets of paper attached to a clipboard. Readings were taken every 3 min on the minute during the baseline phase and every 1 min on the minute during the experimental and reversal phases. The change to 1-min interval recordings was to increase the sensitivity of measurement during the experimental, reversal, and follow-up phases. Frequent reliability checks were accomplished by having two observers simultaneously record individual sessions. Reliability, in this case, reflected the degree to which two observers obtained the same average decibel reading during 20-min observation periods. The smaller score was divided by the larger score. The interobserver reliability was found to exceed 95% in all cases.

Procedure

The study was conducted during a free-study period that occurred daily, Monday through Friday, sometime between 9:00 A.M. and 11:00 A.M. It was during these periods that the class had been noted to be excessively noisy. The sessions recorded ranged in duration from 40 to 60 min, depending upon completion of the morning's activities.

For purposes of this study, the entire class of 29 students was treated as a single responding organism. The decibel intensity readings are a total of the noise produced by the entire class.

After the 10-day baseline period recordings and before the first experimental phase, the teacher informed the pupils of the procedures by which they, as a group, would earn extra gym time.

They were told the following:

> A timer will be set at ten minutes and be allowed to run to zero, at which time a buzzer will sound. Each time the buzzer sounds, you (the class) will receive two extra minutes added to your gym period, and a two-minute break to talk, ask questions, sharpen pencils, or whatever before beginning the next ten-minute period. If, however, you become too noisy at any time during the ten-minute period, Mr. _____ will blow a whistle to let you know and reset the timer back to ten minutes regardless of how many minutes have gone by.

During the reversal phase, the students were told simply that the previous conditions were not in effect. Data were taken without explanation to the students during the follow-up.

It was arbitrarily decided that the noise-level limit be set at 42 db. Thus, the experimenter constantly maintaining the sound meter dial would sound the whistle and reset the timer for each class-produced noise that exceeded 42 db. A 42-db limit proved reasonable since the room without students registered between 36 and 37 db. Sound levels near 42 db were found to be generally acceptable to the teaching staff.

Results

The data for all phases of the experiment are presented in Fig. 1. Each point on the graph represents the average sound-level reading for one session and the vertical lines denote the mean deviation of the sound. The ordinate indicates the sound-level reading in decibels of sound intensity and the abscissa denotes the session with the vertical lines separating the various phases of the experiment. The first phase represents data collected before any contingencies were placed on the

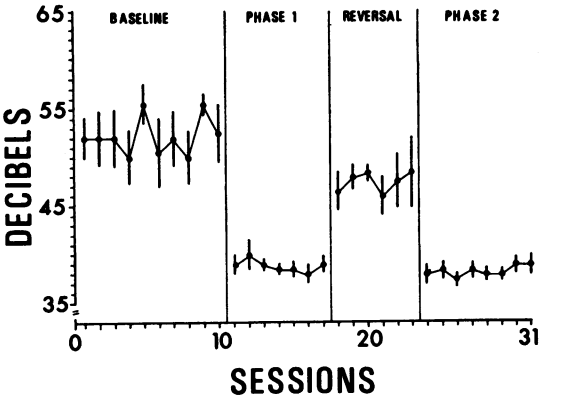

Fig. 1. The effects of sound control procedures on the classroom noise level. Each point represents the average sound-level reading for one session with vertical lines denoting the mean deviation.

classroom sound level, the first experimental phase shows the results of Phase I conditions, the reversal phase is the return to noncontingent conditions, and the second experimental phase is the reinstatement of sound contingencies.

Evidence of the degree of suppression of sound intensity can be seen by comparing the average sound-level readings of the baseline, experimental, reversal, and second experimental phase of the study. The mean readings of the 10 sessions of baseline data in decibels were 52, 52, 52, 50, 55.5, 50.5, 52, 50, 55.5, and 52. The first session of the experimental phase shows an immediate drop from the preceding mean baseline reading of 52.5 to a mean of 39 db, a drop of 13.5 db in sound intensity. The mean 39-db reading indicates that the students were producing little extraneous noise, since the classroom without the students present registered a sound level between 36 and 37 db. The other readings during Phase I averaged 40, 39, 38.5, 38.5, 38, and 39 db per session. During the reversal period, when the baseline conditions were again put into effect, an immediate increase in sound intensity per session averages of 46.5, 48, 48.5, 46, 47.5, and 48.5 db occurred. Although intermediate to the baseline and experimental phases, these readings more closely approximate baseline. During Phase II, when the sound contingencies were again in effect, the sound level lowered to averages of 38, 38.5, 37.5, 38.5, 38, 38, 39, and 39 db per session. As was true in Phase I, this drop was immediate with no apparent transition or gradual reduction of sound level during the first or subsequent sessions.

Figure 2 provides examples of readings taken during individual sessions. The top portion of the figure represents readings taken every 3 min during Sessions 1, 4, 7, and 10 (baseline). Phase I of Fig. 2 shows the recordings taken each minute during Sessions 11, 13, 15, and 17 while Sessions 18, 20, 21, and 23 represent samples of the reversal phase. Sessions 24, 26, 29, and 31 show recordings taken from the second experimental phase. These

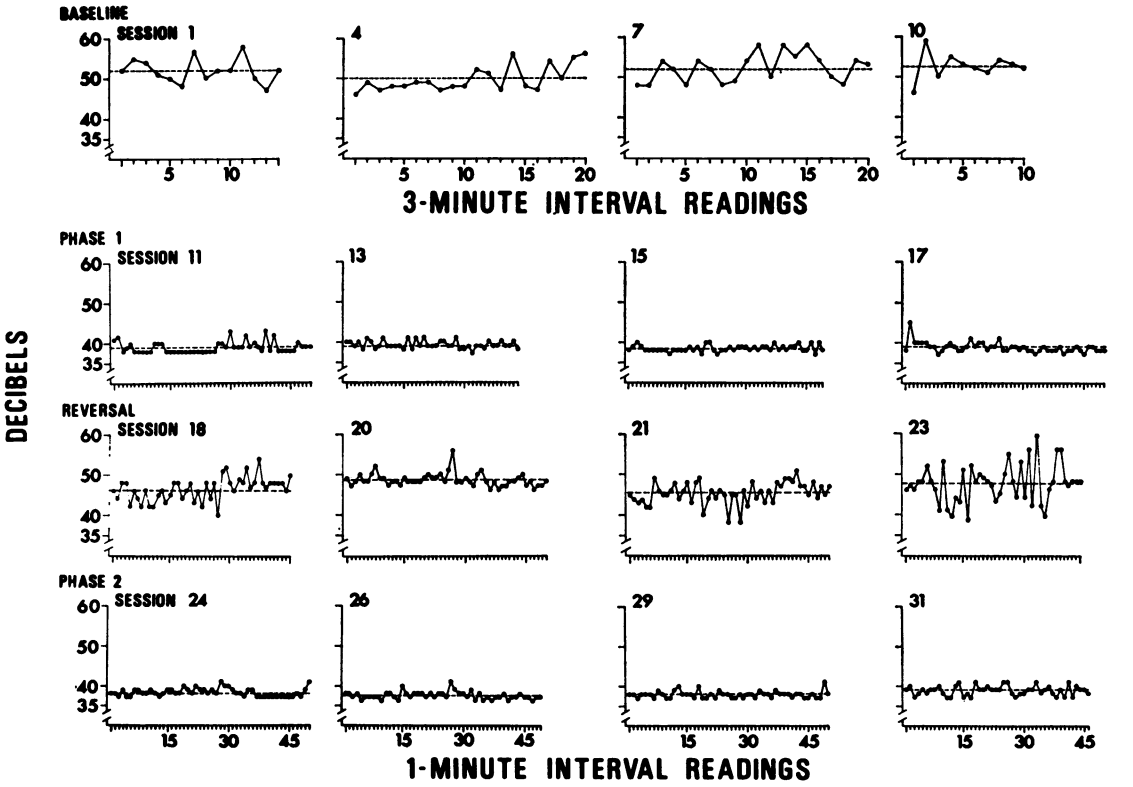

Fig. 2. Typical examples of sound-level readings taken during individual sessions of all four phases. Dotted horizontal lines indicate mean reading for each session.

sessions are typical of each phase and show that the sound levels were uniform throughout each session as well as throughout each session within the phase. The sessions shown in Fig. 2 are the first session, two intermediate sessions, and the last session of each phase.

Discussion

The results of Exp. I show that, under certain specific circumstances, control and suppression of sound-intensity levels can be accomplished in a regular elementary school classroom. The immediate increase of sound intensity during the reversal and its immediate suppression with reinstatement of reinforcement contingencies strongly indicate that the contingencies, in effect, were the crucial variable. While the additional gym time, as well as the 2-min breaks, may have been reinforcing for most students, it need not have necessarily been so for all. Peer consequences in the form of threatening gestures, arm moving, and facial expression were observed being directed at more noisy members of the class. These expressions were also directed at special teachers and the school nurse who were observed entering the room during the quiet periods. Such behaviors on the part of certain students may have had some effect on maintaining quiet.

Quay, Werry, McQueen, and Sprague (1966) pointed out that the economics of public schools require the development of group techniques that will allow children to be handled by as few adults as possible. They further point out that it is crucial at this state that the techniques developed on an individual basis be extended to group situations. The present experiment provided an example of a technique that allows for handling a group as an individual responding organism. In developing methods that are both economically feasible and practical for application to the entire classroom, group procedures such as described here probably hold the most promise of success and acceptance by concerned teachers.

The apparent effectiveness of this technique in suppressing out-of-seat behavior and disturbing antics further suggests its application in the control of individual behavior problems. It may also be helpful in promoting increased learning because studying is generally quite compatible with quietness.

EXPERIMENT II: Control of Noise and Out-of-Seat Behavior and Its Effect upon Teacher Reprimands

In the previous experiment, the teacher noted that the children seemed to be better behaved in relation to their out-of-seat behavior. In this study, data were collected not only on sound level, but on out-of-seat behavior and teacher reprimands as well. During Phase I, contingencies were placed on sound level only with 2-min additional gym period allowed for each unbroken 5-min quiet period. No breaks between quiet periods were allowed. During Phase II, special contingencies of a 5-min loss of gym time were levied on individuals who exceeded the sound level or were found inappropriately out of their seats. Teacher reprimands were recorded throughout all phases. Follow-up phase data were recorded the following school year.

Method

Subjects

A class of 28 second-grade elementary students, 13 boys and 15 girls, was selected for this experiment, again due to excessive noise and other behaviors conflicting with ongoing small reading groups. The children were from the same locale and background and attended the same school as the subjects of Exp. I.

Apparatus

This experiment was conducted in a regular classroom very similar to that described in Exp. I. The apparatus for Phase I was the same as that used in Exp. I.

In Phase II, a common household interval timer with a bell signal was used to control out-of-seat behavior.

Observation Procedures

Sound-level data were recorded by an observer in the rear center of the classroom monitoring the decibel readings dial as in Exp. I. Sound intensities were recorded every minute on the minute throughout all phases.

In addition, every minute on the half minute, the observer recorded the number of students inappropriately out of their seats at that moment. Inappropriate out-of-seat behavior included any student found out of his seat and not directly enroute to or from the reading materials table.

Every teacher-initiated reprimand to the class at large was indicated by an X recorded beneath the 10-sec interval space in which it occurred. The teacher was unaware that reprimand was defined as any statement such as "sit down" or "be quiet, it's too noisy in here" when not directed at one individual as the recipient. Points at which reinforcement or punishment for sound level occurred were similarly indicated on the data sheets. A "D" was used to indicate the point at which the out-of-seat bell sounded and the number of those punished indicated by the number following it.

Interobserver reliability checks were made on the sound-level data by having two observers record readings from the sound meter dial for 20 min. Reliability was calculated by dividing the largest mean reading into the smallest. These checks yielded interobserver reliabilities in excess of 99%. Reliability checks were performed for teacher reprimands by having two observers record the number of reprimands occurring over a 30-min period. The larger number was then divided into the smaller number, yielding interobserver reliabilities of 100%. Interobserver reliabilities were also 100% for out-of-seat tallies by a similar procedure. Two observers recorded the number of students out of their seat every minute on the half minute for 20 min. These tallies were totaled and the largest total was divided into the smallest total.

Procedure

This experiment had five phases. All phases, including the follow-up phase, were conducted during a morning reading class from approximately 8:30 to 9:30 A.M., Monday, Tuesday, Thursday, and Friday. The teacher reported that the excessive noise and the problem of keeping the students at their respective desks without giving each of them her full attention made this particular period especially troublesome to her.

During these periods, small groups of students attended 20-min teacher-led reading sessions held in the rear corner of the classroom. The corner in which these groups were held was partitioned off on one side by a cardboard divider, with the end facing the class left open. If the teacher's voice was loud enough to register on the sound-intensity meter, the minute reading was taken when she paused or terminated her speech. This seldom occurred.

During the 13 baseline sessions, the data were recorded as previously indicated. There were no direct experimeter-induced contingencies in effect throughout this phase.

Phase I: Directly before the first session of Phase I, the teacher read the following message to the class:

> The class has been too noisy and disruptive during the time that I am working with the reading groups, so we are going to let you earn extra time in the gym by being extra quiet. Mr. _____ will set the timer clock for five minutes. Each time the five minutes are up, a buzzer will sound and you will have two minutes extra added to your gym period. The room captain will put marks on the board to show how many extra minutes you have earned. If you become too noisy, Mr. _____ will blow the harmonica and set the timer back to the start of the five minutes without the buzzer ringing.

These procedures were adhered to throughout Phase I without contingencies being placed directly on out-of-seat behavior. The sound-intensity limit used was arbitrarily set at 42 db as in Exp. I. Thus, the harmonica was blown and the timer reset for sound intensities exceeding the 42-db limit, except when reading groups were changing. During these interludes, readings were not taken because of necessary noise created by moving chairs.

Phase II. Directly before the first session of Experimental Phase II, the teacher informed the class of the following procedure and changes. They were informed that they would now have to earn all of their gym period by the method used in Phase I. Under the Phase II conditions, however, the class was allowed to earn 3 min for every unbroken five-min quiet interval. Further, individual pupils who alone created noise in excess of the 42-db limit, such as by yelling across the room or slamming a door, were required to write their names on the blackboard. For each such infraction, they lost 5 min of their individual gym time.

To control out-of-seat behavior, an interval timer with a bell device was continuously set at varied intervals. Each time the timer bell

rang, any students discovered out of their seat and not enroute to or from the reading material were also required to place their names on the blackboard and forfeit 5 min of their gym time. During the first sessions, the timer interval averaged approximately 5 min. This interval was lengthened, reducing the number of bells per session, until it was phased out by the last four Phase II sessions.

During the reversal phase, all conditions were returned to baseline with no contingencies placed upon either the classroom as a whole or upon individuals. The gym period was again established as 15 min in length with no extra time available.

The follow-up data were recorded over five sessions during October and November of the following school year. Conditions were the same as those of baseline, the only major difference being a different teacher.

Results

Figure 3 (top graph) presents the sound-intensity data for all phases of the experiment. As in Exp. I, the class as a whole was treated as a single responding organism with each point on the graph representing the average sound-level reading for one session. The vertical axis indicates the sound-level readings in decibels and the horizontal axis denotes the session with vertical lines separating phases of the experiment. The dotted lines indicate the sessions during which the sound meter was malfunctioning. During these sessions, conditions did not change because the experimenter estimated sound level and acted accordingly.

The degree of suppression of classroom sound level is evidenced by a comparison of the baseline sound-level means with those of the sound-level mean during Phases I and II and reversal phase of the experiment. It can be seen that this was an immediate drop of 12 db. The level during reversal tended to be slightly higher. The number of timer resets that occurred during Phase I averaged 13 per 45-min session, while during Phase II, only 3.86 punishments were levied per session.

Figure 3 (middle graph) represents the cumulative out-of-seat tallies recorded every minute on the half minute. Each point on the graph represents the cumulative tally per 45-min period. The ordinate represents the accumulated tally for each 45-min session and the abscissa denotes the session. Each point represents the summation of these tallies for the first 45 min of each session. Sessions 30 and 34 were omitted because they were less than 45 min in duration. Figure 3 (middle graph) shows that many of the students were out of their seats during the baseline period with little change occurring during the Phase I condition. During Phase II, an immediate and very substantial drop is noted in out-of-seat behavior. This level was maintained throughout the Phase II and reversal sessions. Individual sound-level readings for Phases I and II are similar to those shown for Exp. I. Figure 3 (bottom graph) shows teacher behavior in terms of number of reprimands directed to the class at large per 45-min session. The ordinate represents the actual number of reprimands per session and the abscissa denotes the session number. As can be seen in Fig. 3 (bottom graph), teacher reprimands were

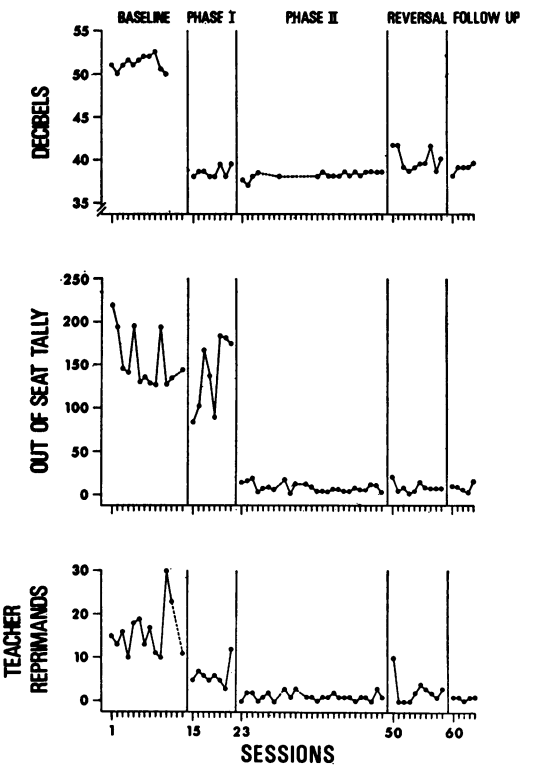

Fig. 3. Top: each point represents average sound-level reading for one session. Middle: each point represents cumulative tally of out-of-seat behavior per 45-min session. Bottom: each point indicates the number of teacher reprimands directly to the class per 45-min session. Dotted lines without points represent equipment malfunction.

highest during baseline with a considerable reduction during Phase I. Phase II data show drastic reduction over the baseline level. A slight increase was noted during reversal, especially the first reversal session. Again, Sessions 30 and 34 were eliminated because they were less than 45 min.

Discussion

The results of Exp. II, consonant with the results of Exp. I, again clearly indicate that under certain specific circumstances, control and suppression of sound-intensity levels can be demonstrated in the elementary school classroom, in this instance, even with younger second graders. Although the data indicate substantial sound-level reduction in Phase I, the average number of timer resettings, relative to the average number of resettings in Phase II (13 to fewer than three) indicates that greater numbers of infractions were occurring, usually between decibel recordings. This may in part have been due largely to less disciplined individuals rather than the group as a whole, since these occurrences largely dropped out with the institution of added individualized contingencies in Phase II. The sound data further indicate that the method is feasible without allowing timeout periods as frequently or of the unstructured type used in Exp. II. This finding suggests that the longer-term reinforcer of accrued gym time in itself may be sufficient to maintain more quiet behaviors.

The technique used here for control of out-of-seat behavior is a simple one that a teacher alone could easily operate or could allow another student to operate. Its effectiveness with these relatively young students implies possible wide application. The present data further suggest that it can be gradually discontinued without loss in effectiveness. This may be because behaviors incompatible with being out of one's seat have been sufficiently strengthened.

The reversal phase, while showing some increase in unwanted behaviors, was still relatively stable at low levels. This may be related to the length of the experimental control phases. The 10 reversal sessions were taken over the last three weeks of school.

During the follow-up phase the next school year, the class was being taught by the same teacher who had previously had them as first graders. It was her opinion that they were very much improved in conduct, particularly in regard to noisiness and being out of their seats. Her impression was supported by the follow-up data. Thus, it appeared that the changes effected in the previous school year were lasting, at least over the summer and following fall.

It is unlikely that the observer's presence influenced the class's behavior during the follow-up phase, since he appeared to be able to enter any classroom at the school without arousing the students' interest or attention. Further, the teacher's impression was that the class did not behave any differently when the observer was not present. Without reliability data, these subjective opinions must be presented in a guarded manner.

The teacher during the follow-up phase, however, had had two years' experience and had been enrolled in the in-service training course in behavior modification for teachers, and thus may have inadvertently been able to exercise increased controls over the class's behavior. She was not yet, however, using any defined behavioral control techniques for this class during or before the follow-up.

While the effects of the changes in procedure in Phase II were effective in gaining control of the classroom noise level and out-of-seat behavior, the fact that both the revised sound control contingencies and institution of the timer for control of out-of-seat behavior were simultaneous makes the assessment of the effect of each move difficult. Changing these conditions at different times would allow a cleaner analysis of the effects of each condition.

EXPERIMENT III: Affecting an Individual's Out-of-Seat Behavior during Group Control Procedures

This experiment followed the behavior of one individual student through all phases of Exp. II. Emphasis was placed on the student's excessive out-of-seat behavior, which was her only noted problem. This behavior was greatly reduced with the institution of a variable-interval timer and bell. Whenever the bell rang, every student inappropriately out of his seat lost 5 min of his gym period.

METHOD

Subject

The subject of this study was a 7-yr-old girl in the second-grade class used in Exp. II. She was chosen for her excessive out-of-seat behaviors which were deemed a problem by the classroom teacher. Other undesirable behaviors, such as talking, *etc.*, were minimal.

Procedure

Data for all phases of this study were collected simultaneously with Exp. II data. The subject's data were very discrete and easily observable, since out-of-seat was defined as any occurring whenever she was not in contact with the seat portion of her chair. A reliability check indicated reliability of 100% between two observers over a 20-min period. Recordings were taken on a 10-sec interval basis. At the end of any 10-sec interval, the observer marked a box on the sheet divided into six boxes per minute (one per 10-sec interval) and 5 min per line. An O was placed in each box if the subject left her seat at any time during that 10-sec interval. A line was placed in the box if she was seated in any manner or permissibly out of her seat (teacher permission for leaving seat or going to and from reading materials).

The observation sessions varied in length, with the shortest being 20 min. Most were near 30 min. Observations were omitted while she attended her reading group. The procedures and apparatus are those described in Exp. II.

RESULTS

Figure 4 indicates the per cent of time the subject was inappropriately out of her seat during the observation period. The baseline data indicate a relatively high and consistent rate of out-of-seat behavior (compared to other students). During Phase I, this rate of out-of-seat behavior increased. During the first session of Phase II, the subject was discovered out of her seat on one occasion and for the remainder of the session remained seated. The subject's out-of-seat behavior was virtually eliminated. As indicated by the reversal, it maintained itself at an even lower rate after the contingencies were removed. The follow-up data indicate that the change had been maintained.

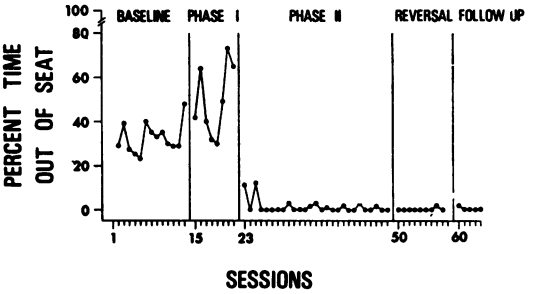

Fig. 4. Each point indicates the per cent of time the subject was inappropriately out of her seat during the observation period.

DISCUSSION

This study represents the behavior of one individual within the class under varied experimental and baseline conditions. The experimenters' somewhat subjective impression suggests that the high degree of suppression of undesirable behavior was probably not as marked in many of the other more deviantly behaving individuals.

At present, the experimenters can offer no explanation for the rise in out-of-seat behavior in Phase I, since the low rate of talking was not significantly altered throughout the experiment. The rapid and highly effective suppression noted in Phase II strongly suggests that the specific interval timer contingencies were responsible for the behavior change.

The maintenance of this low rate of out-of-seat behavior may have in part been the result of reinforcement of the incompatible behaviors required in completion of work. The teacher reported a higher rate of work completed by the student. Praise and better grades (sometimes leading to further reinforcement) followed this.

GENERAL DISCUSSION

Perhaps the most valuable contribution of the tactics of behavior control utilized in this study is in terms of preventing the occurrence of problem behavior. With an understanding of the variables which, when manipulated, can eliminate nonadaptive classroom behavior, teachers will be in a position to program their classrooms so that the probability of such behavior occurring is minimized by the strengthening of more desirable behaviors compatible with educational goals and good

adjustment. In cases where maladaptive behaviors do arise, they could often be dealt with before they were allowed to reach critical proportions.

Further, such tactics used effectively in eliminating and controlling behavior problems may have the added advantage of freeing the teacher so that he might have more time to do a better job of teaching. In order to accomplish this successfully, these tactics must be more often applied to students as a group, rather than as an individual. These studies show that group control procedures are possible in terms of economic feasibility and practicability.

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