Self-Management: A Comparison of the Effects of Self- and Experimenter-Imposed Schedules of Reinforcement on an Academic Response Rate

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SELF-MANAGEMENT: A COMPARISON OF THE EFFECTS OF SELF- AND EXPERIMENTER-IMPOSED SCHEDULES OF REINFORCEMENT ON AN ACADEMIC RESPONSE RATE

by

Robert S. Leopold

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment
of the
Degree of Master of Arts

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August 1977
ACKNOWLEDGEMENTS

I would like to acknowledge and thank Professor Kass Lockhart, Mary Wright, Sigmund Freud, and the city of Boston for their inspiration, support, and guidance.

Robert S. Leopold
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INTRODUCTION

The experimental analysis of behavioral self-management has in recent years received an ever-increasing amount of research attention (Mahoney and Thoresen, 1974; Thoresen and Mahoney, 1974; Watson and Tharp, 1972). Thoresen and Mahoney (1974) have defined self-management as: "...when in the relative absence of immediate external constraints he (the individual) engages in behaviors whose previous probability has been less than that of alternatively available behaviors." Bandura (1971) has conceptualized self-control as a process comprised of three main components: (1) the self prescription of performance criteria; (2) self-evaluation; and (3) self-reinforcement. It should be noted that Kanfer has proposed a similar model.

Self-reinforcement is defined as the administration of a reinforcing stimulus by the subject himself, its presentation contingent on either external stimuli or on a variety of previously established responses in the individual's behavioral repertoire. This phenomenon has been extensively studied by Kanfer (1970) and the reader is directed to his thoughtful summary of research findings related to this area.

Several researchers have found self-reinforcement to be effective in maintaining classroom behavior. Bolstad and Johnson (1972), for example, found that self-reward was slightly superior to external reward in decelerating the rate of disruptive behavior in four subjects. They did not find, however, the self-reward subjects to be more resistant to extinction as they had originally hypothesized. Unfortunately,
the results were confounded by the greater density of reinforcement experienced by subjects in the self-reward condition.

Glynn, Thomas, and Shee (1973) reported that self-control procedures involving self-reward were effective in maintaining high rates of on-task behavior after they had been established through external reinforcement, and this effect was seen to persist through 20 self-control sessions.

The self-observation of behavior has been shown to often have a reactive effect on the behavior being monitored. Self-monitoring has been a standard component of numerous behavior change strategies and the reader is referred to Kazdin (1974) for a more complete discussion of the topic. Further, self-monitoring is a critical component of self-evaluation, which can be seen as an individual’s decision concerning how closely his behavior matches some previously established performance criterion.

The effects of self-evaluation on classroom behavior have been mixed. Kaufman and O'Leary (1972) incorporated self-evaluation in a token economy system designed to reduce disruptive behavior in a tutorial reading class set in a psychiatric hospital. Token exchange was based on teacher ratings (in the form of points) as to the appropriateness of student behavior. In the final phase of the program, students were given the opportunity to rate their own behavior (self-evaluation). Disruptive behaviors were found to remain at the low levels established by the token economy. However, students characteristically awarded themselves the most favorable rating possible and
there was little correlation between student and concurrent teacher evaluations.

In an effort to further assess the effects of self-evaluation, per se, on the rate of disruptive behavior displayed by nine adolescents in a psychiatric hospital school, Santogorssi, O'Leary, Romanczyk, and Kaufman (1973) instituted a self-evaluation procedure in which students rated the appropriateness of their classroom behavior without a prior history of token exchange; that is, there were no contingencies attached to the behavioral ratings. It was found that, although the self-ratings correlated highly with teacher evaluations, self-evaluation alone did not significantly reduce the level of disruptive behavior. A token exchange system was then inaugurated, teacher ratings now being redeemable for prizes. This procedure led to a clear reduction in the incidence of disruptive behavior. In the final phase of the program, when students were given the opportunity to again evaluate their own behavior with evaluations now being redeemable for reward, disruptive behavior returned to its previous high rate. In an effort to explain the discrepancy of their findings with those of Kaufman and O'Leary (1972), the authors speculate that the greater amount of time spent in the teacher-monitored token system (25 vs. 9 days) by the subjects in the earlier study might account for their failure to return to a high rate of disruptive behavior when self-evaluation procedures were again instituted. Further, Kaufman and O'Leary (1972) ran that phase for only seven sessions. The possibility remains that the rate of disruptive behavior would have risen had this phase been prolonged.
In an early study of the standard-setting component in the self-management process, Bandura and Perloff (1967) compared the effects of self-determined performance standards and self-reinforcement with that of experimenter-determined standards and externally administered reinforcement. In one group, children could choose one of four performance schedules by which they would be rewarded for a wheel-cranking response on the experimental apparatus. Subjects in this group also self-administered tokens, which were redeemable for prizes at the end of the session. In another group, each subject was yoked to another in the self-determined group. The performance schedules, although identical to those selected by the children in the self-determined group, were externally imposed. That is, the subject had no option as to which schedule he was to perform under. Token administration, likewise, was externally administered. A non-contingent reinforcement and a no reinforcement group served as controls. It was found that there was no significant difference in the number of responses emitted by subjects in the self- and externally-imposed conditions, although subjects in both these groups exhibited greater productivity than did those in the control groups. Surprisingly, from a reward-cost standpoint, most children did not choose the most favorable schedule of reinforcement. It should be noted that there was a narrow range of schedules (4) from which to choose and subjects could change their decision only once during the course of the session. Moreover, subjects in the reinforcement conditions did not receive their rewards until the end of the experimental session. As noted by Felixbrod and O'Leary
(1973), the promise of a reward is treated as if it were the receipt of the reward itself in this study. These authors question whether this procedure was a true test of reinforcer effectiveness. Further, subjects in the self-determined condition self-administered reinforcement while those in the externally-determined condition had it externally delivered. This inconsistency across conditions presents difficulty when one is interested in assessing the effects of self- versus external imposition of performance standards in isolation. Finally, one must question the generalizability of research conducted for a single session in a highly reactive laboratory setting with the defined response bearing little resemblance to behaviors characteristically observed in the natural environment.

Weiner and Dubanoski (1975) investigated the effect of self- versus externally-imposed schedules of reinforcement on resistance to extinction. Subjects in one group could choose one of three schedules on which they would be rewarded for dropping a ball into a game-like apparatus. Subjects in another group had similar schedules imposed on them. Tokens redeemable for prizes at the end of the session were externally administered in both conditions. After 20 contingently reinforced responses extinction procedures were instituted for all subjects. It was found that subjects in the self-determined condition emitted significantly more responses in extinction than did those in the externally-imposed group. Criticisms leveled earlier against the work of Bandura and Perloff (1967) concerning the reactivity of the testing situation and the artificiality of the defined response, apply equally to the
research presently under discussion.

In an early classroom study, Lovitt and Curtiss (1969) investigated the effects of teacher-specified versus student-specified contingencies on the academic response rate of a twelve-year-old subject. The self-specification of contingencies was seen to lead to an increase in academic performance. Unfortunately, the generality of this finding may be limited by the fact that the sole subject had previously experienced a two-year period of token reinforcement in the classroom. In addition, the observed superiority of child-specified contingencies was confounded by a concomitant increase in the magnitude of reinforcement. Finally, Glass, Willson, and Gottman (1975), in a statistical time-series analysis of Lovitt and Curtiss's findings, found no significant difference in performance between the child- and teacher-specified conditions.

Glynn (1970), also using academic response rate as the major dependent variable, compared the effects of experimenter-determined, self-determined, and chance-determined reinforcement in a class of ninth grade students; reinforcement was self-administered in all conditions. Experimenter- and self-determined contingencies were found to be equally efficacious in improving test performance. Subjects were also seen to have increased the severity of their self-imposed work requirement over time. The methodological weaknesses of this study include: (1) the subjects received back-up reinforcers at the end of a complete token phase rather than at the end of each session. Again, the promise of a reward is treated as the receipt of the reward.
itself; (2) there existed an extremely limited range of standards from which to select, and (3) subjects were nonrandomly assigned to the conditions and exhibited unequal baseline performances.

Finally, Felixbrod and O'Leary (1973) examined the effects of setting performance standards on the solution of arithmetic problems with 24 subjects drawn from two second grade classrooms. The experimental sessions were 20 minutes in length and were conducted in a separate classroom. Of major interest in the study was the change in self-selected performance standards (in the form of correct problems per token) over time. The authors found no significant difference in performance between the self- and externally-imposed conditions, and subjects were found to become progressively more lenient (fewer correct problems per token) in the standards they selected over the course of the experiment. It should be commented that the experiment was run for an inordinantly brief time (six, twenty-minute sessions) and was conducted in a setting outside the classroom.

The ability of an individual to manage his own behavior in the absence of external constraint or supervision can be seen as the focus of what has been called the socialization process. Much of an individual's early training in the home and school is directed toward insuring that he will behave appropriately in situations where the more obvious mechanisms of social control are not in evidence. Indeed, it seems difficult to imagine a society whose members could not be expected in a variety of situations to behave in a socially responsible manner. Seen in this way, research concerning the self-management of behavior
becomes of utmost importance. Research applications appear obvious: teachers freed of the responsibility to attend to disruptive student behavior would be able to devote their time to constructive pedagogic activities. Reliable self-control strategies would greatly expand the clinician's therapeutic armamentarium and insure that behavior change induced in therapy would generalize and be maintained in the extra-therapeutic environment.

Clearly, the research on self-management has shown it to be a procedure of potential benefit to both the individual and to agents of social control. It is also manifestly evident that further, methodologically sound research must be conducted to firmly delineate the functional variables surrounding the self-management process.

In line with the preceding remarks, this study dealt with one component of the self-management process, that being the self-imposition of performance standards. It was conducted in an intact classroom, and employed an academic response as its major dependent variable. Of primary interest were:

1. the effect of the self-imposition of a performance standard on an academic response rate,
2. the range of such standards selected, and
3. the preference for alternative reinforcement conditions.
METHOD

Subjects and Setting

Twenty-four students in a normal fourth grade classroom served as subjects.

Materials

Performance on Hutchings' "low fatigue" algorithm (Alessi, 1974) served as the primary dependent measure. These problems were arranged in five column by seven row matrices randomly generated by a computer. Three pages of problems six problems to the page, were presented to the subjects during each session. A five by seven matrix requires 34 binary calculations and four carrying operations in its completion (see Figure 1). In the present study, a response was defined as a correct binary calculation (enclosed by squares in Figure 1). Carrying and prerequisite counting were not included within the response definition.

All subjects were simultaneously exposed to Hutchings' addition algorithm lesson and addition algorithm review (Alessi, 1974). Both lessons were standardized, 30-minute presentations and were introduced on two consecutive days. Three additional 10-minute practice sessions were required for a majority of the subjects to reliably acquire the response.
Figure 1: Completed algorithms with binary calculations.
Figure I

Completed Algorithms with Binary Calculations

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Completed Algorithms with Binary Calculations

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Procedure

The three experimental conditions (baseline; self-determined; experimenter-determined) were randomly presented in a multielement baseline design (Ulman and Sulzer-Azaroff, 1975). This design involves the repeated measure of the response under alternating conditions of the independent variable. Unlike the reversal and multiple baseline designs, a change of conditions is made independent of the behavior under observation. A distinctive stimulus is associated with each condition and "if the subject's behavior is fractioned by stimulus control over each separate element" (Sidman, 1960), then experimental control has been demonstrated.

In all three conditions, subjects worked on the addition algorithms during a 10-minute period. At the end of that period, two experimenters went from desk to desk and marked each problem as either correct or incorrect before writing the total number of problems correctly completed directly on the subject's problem sheet. No oral feedback was provided the subject concerning his performance. As the response was a discrete, easily discernable permanent product, reliability was not seen to be a relevant concern.

Baseline sessions were announced by an orange colored paper stapled to the problem sheets which stated: "Today you will not be earning any free time for your work on the addition problems." Subjects were then allowed ten minutes in which to work on the problems. At the end of that period, the two experimenters marked the papers in the manner described in the previous paragraph.
Similarly, the self-determined sessions were announced by a white paper stapled to the problem sheets which stated:

**CHOICE DAY**

Today you will earn free time for correct answers to the arithmetic problems. You can also pick how many right answers you will need to earn the free time. Please circle the number in front of the sentence that tells how many right answers you will need to earn one minute of free time.

1. This means that for every right answer you will earn one minute of free time.
2. This means that for every two right answers you will earn one minute of free time.
3. This means that for every three right answers you will earn one minute of free time.
4. This means that for every four right answers you will earn one minute of free time.
5. This means that for every five right answers you will earn one minute of free time.

This is your choice. Please make it on your own.

Special care was taken in the initial self-determined session to insure that all subjects understood the actual performance/reward ratio specified by each sentence before they were requested to circle the number of their choice.

The class was customarily dismissed for recess at 1:40. The classroom teacher allowed the experimenters the period between 1:30 and 1:40 to be used as free time. After marking the papers in the manner previously described, the experimenters translated the number of correct problems into minutes of free time at the rate specified by the subject. That is, if the subject had chosen the statement specifying one correct problem per minute of free time and had completed four problems correctly, he was told that he had earned four
minutes of free time and was dismissed to recess at 1:36 instead of the customary 1:40. An experimenter sat in the back of the room after all the papers had been marked and dismissed each subject individually at the appropriate time.

The experimenter-determined sessions were announced by a pink sheet which stated: "Today you will earn one minute of free time for every ___ correct answers to the arithmetic problems." The free time/performance ratio specified in the statement was identical to that chosen by the subject in the previous self-determined session. The remainder of the session was conducted in a manner identical to that described in the self-determined condition.
RESULTS

Results were analyzed using the data from 21 subjects. The data from three subjects initially included in the study are not reported: one subject was absent during a major portion of the experiment while two others did not reliably acquire the response.

Grouped data, illustrating the mean number of addition algorithms completed correctly per session across all conditions are presented in Figure 2. The number of problems completed in baseline sessions remained relatively stable, increasing from a mean of 3.52 in the first baseline session to a high of 3.94 recorded in the final baseline session (Session 15). Problems completed in the two reinforcement conditions were roughly equivalent. The mean number of problems completed correctly across all sessions of each condition was: baseline, 3.69; self-determined, 5.12; experimenter-determined, 5.01.

Table 1 presents individual data representing the number of problems correctly completed during each 10-minute experimental session. For most subjects, their production was fairly consistent, differing no more than one or two problems in adjacent sessions.

Figure 3 shows the effect of self- and experimenter-imposed schedules of reinforcement on the rate of correct binary addition. Although consistently higher than baseline, differences in the rate of responding between the two reinforcement conditions, most clearly seen in Sessions 5 to 8 and 11 to 16, were marginal. The mean number of correct binaries computed per minute across all sessions of each
Figure 2: Mean number of correct solutions computed to addition algorithms per session.
Figure II

Mean Number of Correct Solutions Computed to Addition Algorithms Per Session

- ○ BASELINE
- □ SELF-DETERMINED
- △ EXP.-DETERMINED
Table I: Number of correct solutions to addition algorithms per session.
### Table 1
Number of Correct Solutions to Addition Algorithms Per Session

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Figure 3: Mean number of binary calculations generated per minute.
Figure III
Mean Number of Binary Calculations Per Minute

- •• BASELINE
- • SELF-DETERMINED
- ▲ EXP.-DETERMINED

MEAN CORRECT BINARY PER MINUTE

SESSION
condition was: baseline, 17.42; self-imposed, 20.64; experimenter-imposed, 21.07.

Table 2 presents the number of correct binaries generated per minute by each subject in all sessions of each condition. Rates across sessions were generally seen to ascend and, for many subjects, there was no decrement in response rate during baseline sessions. For example, Subject 1 was seen to complete more binaries in Baseline Sessions 10 and 15 than in any session of the two reinforcement conditions. Further, 12 out of 21 subjects were observed to emit more responses in Session 3 (baseline) than in the preceding self-imposed session.

One hundred percent of the subjects chose the most favorable schedule of reinforcement (one minute free time per correct problem) and no subject was seen to opt for a more stringent schedule in any of the later sessions.

At the end of the study, subjects were verbally requested to write on their problem sheets the name of the condition they "liked best". One hundred percent of the subjects responded that they preferred "Choice Day," or the self-determined condition.
Table 2: Number of correct binary calculations generated per minute across all conditions.
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DISCUSSION

This experiment examined the effects of self- versus experimenter-imposed schedules of reinforcement on an academic response. Both reinforcement conditions proved equally efficacious in maintaining higher response rates than in baseline. Thus, the results of the present experiment are consistent with the findings of Bandura and Perloff (1967), Glynn (1970), and Felixbrod and O'Leary (1973), but are discrepant with those of Lovitt and Curtiss (1969). The superiority of self-imposed contingencies reported by those investigators was not observed in the present study, and cast further doubt on the generality of their findings. Moreover, the response employed in the present study, binary calculations generated with Hutchings' algorithms, has given evidence of being sensitive to changes in environmental contingencies (Lewis, 1976). As can be seen from an analysis of grouped data the mean number of binaries computed per minute across all sessions was almost identical in the two reinforcement conditions, strongly suggesting that there is no differential effect on response rate between them.

An analysis of individual data reveals that, for many subjects, the response was not under demonstrable control. The classroom teacher was present at the head of the class during all sessions. At the end of each session, a number of subjects were seen to gather around the teacher's desk and report on "how well" they had done that day. Although the teacher was informed that she should remain noncommittal on
hearing these statements, the possibility remains that the subjects received surreptitious reinforcement for work on the algorithms in the form of teacher praise and attention. Additionally, it could very well be that the opportunity to leave a few minutes early for recess was, for many subjects, of insufficient value to clearly control response rates.

It should be noted that the subjects were awarded free time for correct solutions to the addition algorithms. However, the response of major experimental interest was the binary calculation imbedded within the algorithm. A five column by seven row addition algorithm requires a fairly long time to complete: the best subject in the present study could complete no more than ten problems in a ten-minute period. By the last session, most subjects were averaging six problems completed correctly. It was concluded that, given the small number of correct solutions generated in a ten-minute session, such a measure would prove of insufficient sensitivity to changes in reinforcement contingencies. Binary calculations, with their significantly higher rate of occurrence, serve as a more sensitive, correlary measure of the response actually undergoing the experimental manipulation.

One hundred percent of the subjects in the present study immediately adopted the most lenient schedule of reinforcement. Bandura and Perloff (1967), to the contrary found that subjects did not necessarily maximize reinforcement. Several procedural differences in the two studies might account for the differences in the finding. First, unlike the present investigation, where subjects could change their self-imposed
standards during any of the five self-determined sessions, subjects in the earlier study could modify their choice only once. Second, as mentioned earlier, subjects in the earlier study did not receive prior exposure to the reinforcers (in the form of prizes) and were not awarded them until the end of the experiment. Subjects in the present study were awarded free time immediately after each experimental session. As commented by Felixbrod and O'Leary (1973), Bandura and Perloff (1967) treat the promise of reinforcement as if it were the delivery of the reinforcer itself.

Felixbrod and O'Leary (1973) found, similarly, that five out of eight subjects initially imposed the most stringent performance standard upon themselves. However, subjects were thereafter observed to self-impose progressively more lenient standards. These authors comment: "...two or three of the children who self-selected the most austere performance demand in the first session remarked that they thought that choosing 10 problems per point meant that they would be receiving the most points possible for each correct answer. In other words, some children initially may not have realized that in this study one maximized reinforcement by choosing one rather than 10 problems per point." In the present investigation, performance standards were clearly defined in an attempt to avoid confusion on the subject's part.

In summary, the present study indicates that subjects in the absence of surveillance and externally administered aversive contingencies will overwhelmingly tend to select the most lenient
One hundred percent of the subjects also indicated that they preferred the self-determined condition. Unfortunately, this result must be considered anecdotal, in that stated preference does not always accurately reflect actual behavior (Morgan and Lindsley, 1966). Yet, it does give some evidence that the implementation of self-management procedures in the classroom might aid in creating an atmosphere that is more rewarding for both student and teacher. Keller (1968) stated that the goal of educational technology should not only be superior academic performance but the development of a system that is reinforcing for each student. Further studies might determine subject preference for alternative reinforcement conditions through the use of preference assessment techniques of the type used by Lockhart, Sexton, and Lea (1973).

In conclusion, the present research further demonstrates the feasibility of incorporating self-management strategies in the classroom. It also substantiates earlier research (Glynn, 1970; Felixbrod and O'Leary, 1973) demonstrating the equal efficacy of self- versus experimenter-imposed schedules of reinforcement on the maintenance of response rates. It is the present author's belief that researchers should cease posing the question: How effective is self-control when compared to more obvious forms of external control? It is our contention, backed by a growing body of literature (Thoresen and Mahoney, 1974) that both forms of control are equally efficacious. Researchers should instead ask: What are the variables which insure an individual's
ability to manage his own behavior in a number of potentially dissim­iliar environments? In this way, the behavioral scientist may begin
to, paraphrasing Carl Thoresen (1974), couple behavioral means to
the humanistic ends of increasing the number of environmental options
available and widen the breadth of individual response repertoires.
REFERENCES


