EFFECTS OF REINFORCEMENT ON CHILDREN'S ACADEMIC BEHAVIOR AS A FUNCTION OF SELF-DETERMINED AND EXTERNALLY IMPOSED CONTINGENCIES[1]

JEFFREY J. FELIXBROD AND K. DANIEL O'LEARY

STATE UNIVERSITY OF NEW YORK AT STONY BROOK

This experiment was designed to compare the effects of contingent reinforcement under conditions of self-determined and externally imposed performance standards. A major purpose was to examine the maintenance of self-imposed performance standards over time. Children in one contingent reinforcement condition self-determined their academic performance standards. The same performance standards were externally imposed upon children in a second contingent reinforcement condition who were yoked to subjects in the first condition. Children in a no-reinforcement control condition performed in the absence of external reward. Behavioral productivity of the self-determination condition was greater than that of the no-reinforcement condition. Further, no attenuation of the efficacy of contingent reinforcement occurred when performance standards were self-determined rather than externally imposed. Over six sessions, children became progressively more lenient in their self-imposed performance demands in the absence of social surveillance.

Although much is known about the regulation of behavior through external means, insufficient attention has been paid to variables governing behavioral self-management. O'Leary and O'Leary (1972, p. 544) pointed out that ". . . the area of self-control suffers from the absence of research which clearly demonstrates the efficacy of self-control procedures in naturalistic settings." In particular, little research has focused upon a comparison of the effects of rein-

forcement in situations in which performance standards are self-determined, rather than externally imposed. Further, there has been little assessment of the manner in which self-imposed performance standards change over time in naturalistic settings.

The effects of a combination of self-determined performance standards and self-administered reinforcement were compared with the effects of a combination of externally imposed performance standards and externally administered reinforcement in a study by Bandura and Perloff (1967). Children in one condition self-selected their reinforcement criteria for work on a motor task, and self-administered their rewards upon reaching their self-imposed standards. Each child in this group had a yoked counterpart in a second condition, for whom performance standards were externally imposed and for whom reinforcement was externally administered contingent upon achievement of the standard. Noncontingent reinforcement and no-incentive control conditions were also employed. There was no significant difference in performance between the self- and external contingent reinforcement conditions. Subjects in both of these conditions,

however, showed greater productivity than subjects in the control conditions.

Lovitt and Curtiss (1969) found that when a 12-yr-old boy in a special class for children with behavioral problems was permitted to determine his own academic performance requirements, his academic response rate was higher than it was when his teacher arranged the contingency requirements. In one portion of the study in which the contingency manager, the teacher, was held constant, a peculiar finding concerning the self-determination of standards was that the child's academic response rate was lower when the magnitude of reinforcement was higher. However, the replicability of these results is open to question since the median differences in academic response rate between the self- and teacher-imposed conditions were small, and the data were not analyzed to determine whether the obtained differences were statistically significant. The experimental design employed by Lovitt and Curtiss (1969) did not, however, permit clear assessment of the manner in which self-imposed performance standards vary over time.

Glynn (1970) investigated the effects of self-determined and experimenter-determined reinforcement on the test scores of ninth-grade girls. The experimental procedure included self-recording by subjects in each treatment condition, and self-administration of token reinforcement in all but a no-token control condition. In one token reinforcement phase, self-determined and experimenter-determined reinforcement were equally efficacious, and both were superior to chance-determined reinforcement and a no-token control condition. However, this study suffered from a number of methodological shortcomings. As Glynn (1970) pointed out, the range of performance standards available for self-selection was limited, and the prizes used as back-ups apparently were not of high reinforcement magnitude. In addition, mean performance scores for the four experimental conditions were unequal in the initial baseline phase.

The present experiment was designed to compare the effects of contingent reinforcement under conditions of self-determined and externally imposed performance standards. Elementary school children in one contingent reinforcement condition self-determined their academic performance standards. In a second contingent reinforcement condition, in which performance standards were externally imposed, children were yoked to subjects in the first condition so that the same performance standards were set for them. A no-reinforcement control condition was also employed.

A major purpose of the present study was to investigate changes in self-selected performance standards over time. Bandura and Perloff (1967) emphasized the fact that some children in their laboratory analogue study tended to impose upon themselves highly austere performance requirements, and thus failed to maximize reinforcement. Bandura and Perloff (1967) believe this finding to be of considerable theoretical and practical importance. However, it should be noted that the experiments of Bandura and Perloff (1967) and Glynn (1970) exemplify an unfortunate practice that is common in research employing human subjects. This practice is to treat the *promise* of a reward, which may be a discriminative stimulus, as though it were the *receipt* of a reward. Children in the "reinforcement" conditions of the Bandura and Perloff (1967) study, which lasted only one session, did not receive any prizes until after the study was over and all data had been collected. Similarly, children in the "reinforcement" conditions of Glynn's (1970) study received back-up reinforcement only at the end of the entire token reinforcement phase, rather than at the end of every test session. This procedure fails to test the effects of reinforcing consequences; it tests only the effects of a cue (the promise of reinforcement). The present experiment, on the other hand, provided a true test of the effects of reinforcement, because contingent reinforcement was administered to children in the appropriate conditions after each session. The present study, which lasted six sessions, permitted children in

the self-determination condition to change their performance standards up to five times.

It was predicted that the behavioral productivity of the self-determination group would be greater than that of the no-reinforcement group. Further, it was predicted that the behavior maintenance properties of contingent reinforcement would not be attenuated when performance standards were self-determined, rather than externally administered. No prediction was made concerning the maintenance of self-imposed performance standards over time.

METHOD

Subjects

Twenty-four second-grade children, 12 boys and 12 girls enrolled in a Long Island, New York public school, were drawn from two classrooms. The children were of average intelligence, and most were lower-middle class. The experiment was conducted during the spring semester of the school year.

Setting and Material

The experiment was conducted in separate rooms provided by the school. Subjects were tested individually. The experimental task involved presenting each subject with grade-level appropriate arithmetic problems. At the beginning of every session, each subject was given a packet of 12 sheets of paper; each sheet contained 20 arithmetic problems. All subjects were presented with the same arithmetic questions in the same order during any one session. Questions increased in difficulty within a session, but randomization procedures employed in the selection of arithmetic problems assured constancy of difficulty level across sessions. No child was able to complete all of the problems in any session.

Procedure

A 3 × 6 factorial design was employed, with the factors being experimental conditions and sessions. Six sessions, each lasting up to 20 min, were conducted every Monday, Wednesday, and Friday, with the exceptions of school holidays and pupil absences. Absentees were tested on Tuesdays and Thursdays. Subjects in all three conditions were tested during the same instructional periods to prevent potential confounding due to differential absence from classroom activities.

Eight groups, each consisting of three children, were formed. Subjects within each group were matched on the basis of sex and score on a 20-min arithmetic pretest that had been administered to each child individually. Each subject was then randomly assigned to one of three experimental conditions: (a) a contingent reinforcement condition in which performance standards were self-determined (*SD*); (b) a contingent reinforcement condition in which performance standards were externally imposed (*EI*); (c) a no-reinforcement control condition (*NR*). Assignment was performed so that each of the three experimental conditions was represented in every group. In other words, each group consisted of one child in each experimental condition. Two matched groups of three subjects each were randomly assigned to one of four female undergraduate experimenters. Throughout the study, an experimenter tested only those children assigned to her.

Each subject was taken individually from his classroom to a small utility room, in which the experiment was conducted. The experimenter then introduced the relevant treatment condition. The following instructions were read to subjects in the *SD* condition:

> When people work on a job, they get paid for what they do. I am going to pay you POINTS which you can use to buy these prizes. (Experimenter points at prizes.) *Your* job is to answer these arithmetic questions. Answer the questions in order. Do not skip a question unless you do not know how to answer it. If you finish a page, go on to the next page. In order to earn points, only correct answers will count. (Experimenter repeats that only correct answers will count.) You will have 20 minutes to do

these. But you can stop before 20 minutes are up if you want to. Just come outside the door where I'll be waiting, if you want to stop sooner.

How many right answers do you want to do, to earn each point? I am going to let *YOU* decide how many problems you want to answer right in order to earn each point. See these prizes. Let's take a look at how much they cost. (Experimenter describes prizes and their point exchange values.)

See this list of choices. (Experimenter points to a separate page on which the subject is to choose a performance standard.) *YOU* get to choose how many right answers you want to do for each point. (Experimenter points to each possible choice in a list of 10 possible performance standards: 1 right answer = 1 point; 2 right answers = 1 point; . . . 10 right answers = 1 point.) Now think to yourself. How many problems do you want to do right for each point?

After I leave the room, draw a circle around the number of right answers you want to do for each point.

Any questions? O.K., what's the first thing you're going to do after I leave? (Subject should respond appropriately.)

Remember, you can stop and leave when you want to, or else I'll tell you when the 20 minutes are up. I will be right outside. (Experimenter repeats the instructions if necessary.)

At the start of Sessions 2 through 6, the experimenter again read the instructions. During these sessions, subjects in the self-determination condition were given the opportunity to choose the same or a different performance standard.

Subjects in the external imposition condition were treated in the same manner as subjects in the self-determination condition, with the following exception: the performance standard was imposed upon the child by the experimenter. In other words, the performance standards adopted by a child in the self-determination condition were applied to the subject paired with him in the external imposition condition. Thus, for

example, if a particular child in the *SD* condition chose to solve five problems per point in Session 1, three problems per point in Sessions 2 and 3, and one problem per point in Sessions 4, 5, and 6, the same pattern of performance standards was set for his matched counterpart in the *EI* condition. For children in the no-reinforcement condition, performance standards were neither self-determined nor externally imposed. Subjects were asked to solve the arithmetic problems, but were informed that they would be paid neither points nor prizes for their efforts.

Bandura and Perloff (1967) described the use of procedures designed to minimize extraneous social influence. In the present study, subjects performed the task in the absence of the experimenter. Subjects in the self-determination condition did not self-select a performance standard until after the experimenter had left the room. Liebert, Spiegler, and Hall (1970) noted that incidental modelling cues may influence performance in novel situations. It was for this reason that the experimenter pointed to each of the 10 possible performance standards that a child in the self-determination condition could choose. Reinforcers consisted of candy and toys that ranged in value from one cent to about two dollars. The prizes were openly displayed while children in the reinforcement conditions performed the task; no prizes were present while subjects in the no-reinforcement condition performed. The experimenters reported that, in general, the children seemed to be deeply impressed by the more expensive prizes. At the end of each session, subjects in the self-determination and external imposition conditions were required to exchange for reinforcers all the points they had earned. Prizes were placed in paper bags that were delivered by the experimenter to the teacher. Children received their prizes from the teacher at the end of the school day.

Major dependent variables were the number of correct problem solutions, amount of time spent in the task setting, rate of correct problem solution, and percentage of problems solved correctly. In addition, performance standards

selected by *SD* subjects at the beginning of each session were recorded.

RESULTS

Correct Solutions

Figure 1 presents the mean number of arithmetic problems solved correctly by subjects in the three experimental conditions for each of the six sessions.[2] The group data presented in this report are generally representative of the behavior of individual subjects.[3] The mean pretest scores for the three conditions were almost identical. Analysis of variance disclosed a significant main effect due to experimental con-

[2]When a subject was absent from a particular session and could not be retested, the mean score of the remaining seven subjects in his experimental condition was recorded as the absentee's score for that session. This occurred only twice.

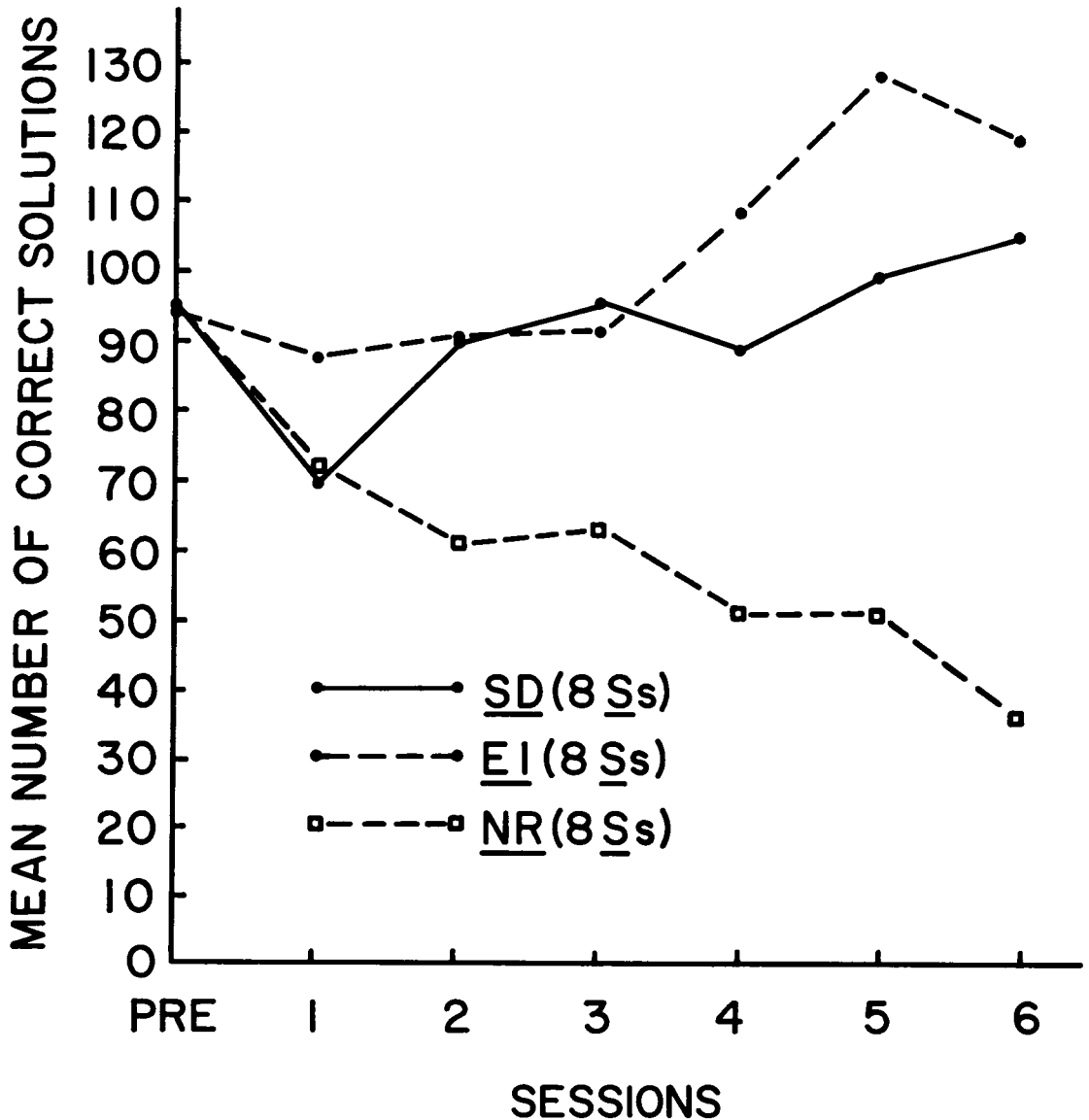[3]Data for individual subjects may be obtained from the authors upon request.

Fig. 1. Number of arithmetic problems solved correctly by subjects in the self-determination (*SD*), external imposition (*EI*), and no-reinforcement (*NR*) conditions.

ditions $(F = 6.57, df = 2, 21, p < 0.01)$. A Newman-Keuls comparison of SD and NR means for the six sessions combined was significant $(p < 0.05)$, thus confirming the hypothesis that contingent reinforcement is superior to no-reinforcement when performance standards are self-determined. Subjects in the SD condition averaged 91.73 correct solutions per session, while NR subjects averaged 55.56. A Newman-Keuls comparison of EI and NR means was also significant $(p < 0.01)$. An average of 104.71 correct solutions per session was achieved by EI subjects. The hypothesis that the effects of contingent reinforcement are not significantly different under conditions of self-determined and externally imposed performance standards also received support. A Newman-Keuls comparison of SD and EI means for the six sessions combined revealed no significant difference.

The analysis of variance showed a nonsignificant sessions effect $(F = 1.91, df = 5, 105, n.s.)$. This is apparently due to the fact that while SD and EI means tended to increase over sessions, NR means tended to decline. However, there was a highly significant Treatments X Sessions interaction $(F = 4.94, df = 10, 105, p < 0.001)$. A series of Newman-Keuls comparisons was employed to examine this finding further. Table 1 presents the results of SD vs NR, EI vs NR, and SD vs EI comparisons for each of the six sessions. The superiority in performance of the SD and EI conditions relative to the NR condition was apparent in the latter three sessions. SD vs EI comparisons revealed significance in only one of the six sessions (Session 5), with the EI condition showing better performance.

Time at Task

Figure 2 presents the mean number of minutes spent in the task setting by subjects in the three experimental conditions for each of the six sessions. Analysis of variance of these data disclosed a highly significant main effect due to experimental conditions $(F = 17.59, df = 2, 21, p < 0.001)$. A Newman-Keuls comparison of the SD and NR means for the six sessions combined was significant $(p < 0.01)$, thus confirming the hypothesis that contingent reinforcement following self-imposed performance standards is superior to no-reinforcement. Subjects in the SD condition spent an average of 19.40 min per session in the task setting while NR subjects averaged 12.23 min. A Newman-Keuls comparison of EI and NR means was also significant $(p < 0.01)$. EI subjects spent an average of 18.48 min per session in the task setting. The hypothesis that the effects of contingent reinforcement are not significantly different under conditions of self-determined and externally administered performance requirements was also confirmed. There was no significant difference between SD and EI means for the six sessions combined.

As was the case on the dependent variable of correct solutions, the analysis of variance revealed a nonsignificant trials effect $(F = 1.16, df = 5, 105, n.s.)$, but the Treatments X Sessions interaction was significant $(F = 2.61, df = 10, 105, p < 0.01)$. Newman-Keuls comparisons were employed to explore this latter finding further. Table 2 presents the results of SD vs NR, EI vs NR, and SD vs EI comparisons for each of

Table 1

Newman-Keuls Comparisons of Mean Number of Correct Problem Solutions

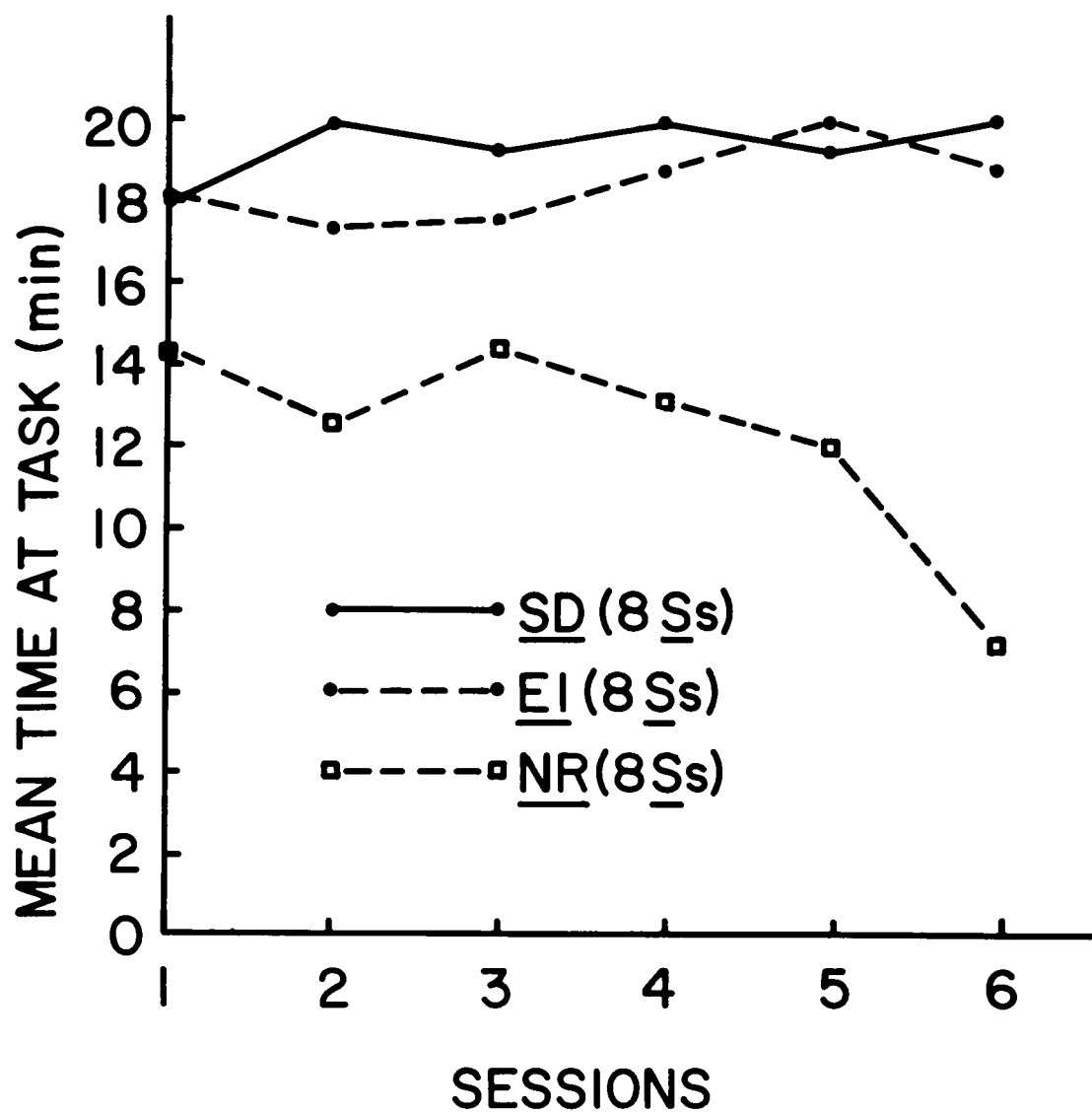|	Session					
	I	II	III	IV	V	VI
SD vs NR	n.s.	n.s.	$p < 0.05$	$p < 0.01$	$p < 0.01$	$p < 0.01$
EI vs NR	n.s.	n.s.	n.s.	$p < 0.01$	$p < 0.01$	$p < 0.01$
SD vs EI	n.s.	n.s.	n.s.	n.s.	$p < 0.05$*	n.s.

*EI condition superior

Fig. 2. Time spent in task-setting by subjects in the self-determination (*SD*), external imposition (*EI*), and no-reinforcement (*NR*) conditions.

Table 2

Newman-Keuls Comparisons of Mean Time at Task Scores

		Session				
	I	*II*	*III*	*IV*	*V*	*VI*
SD vs NR	n.s.	$p < 0.01$	n.s.	$p < 0.01$	$p < 0.01$	$p < 0.01$
EI vs NR	n.s.	$p < 0.05$	n.s.	$p < 0.05$	$p < 0.01$	$p < 0.01$
SD vs EI	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

the sessions. The superiority of the *SD* and *EI* conditions relative to the *NR* condition was apparent in Sessions 2, 4, 5, and 6. In none of the six sessions did *SD vs EI* comparisons show a significant difference.

Other Dependent Variables

Analysis of variance of the rate of correct problem solution revealed a significant main effect for trials ($F = 3.59, df = 5, 105, p < 0.01$). This result was apparently due to the fact that subjects tended to increase in rate of correct problem solution over sessions. Neither the main effect for experimental conditions ($F = 1.24, df = 2, 21$, *n.s.*) nor the Treatments X Sessions interaction ($F = 1.63, df = 10, 105$, *n.s.*) was significant.

No significant effects were disclosed by analysis of variance of the percentage of questions answered correctly. An average of 92.4%, 95.0%, and 86.3% of the questions were correctly answered by *SD, EI* and *NR* subjects, respectively.

Self-Determined Performance Standards

Table 3 indicates the performance standards chosen by subjects in the *SD* condition at the start of each session. Subjects could choose to solve correctly between 1 and 10 *problems* per *point*. These data reveal that at the start of the first session, five of the eight *SD* subjects selected the most difficult performance requirement,

Table 3

Number of correct problem solutions per point selected by subjects in the self-determination condition.

	Session					
	I	II	III	IV	V	VI
SD 1	10	10	2	1	10	2
SD 2	10	9	10	10	1	1
SD 3	10	8	5	3	8	1
SD 4	1	1	1	1	1	1
SD 5	10	1	1	1	1	1
SD 6	1	10	1	1	1	1
SD 7	6	1	1	1	1	absent
SD 8	10	1	1	1	1	1
X=	7.25	5.13	2.75	2.38	3.00	1.13

while only two subjects chose the most lenient standard. However, at the start of the last session, six children selected the most lenient standard, while no child chose the most difficult performance requirement. The one child who was absent from the last session had chosen the most lenient standard in the four previous sessions.

A two-way analysis of variance (Sessions X Subjects) of the self-determined performance standards was executed. Both the main effect for sessions ($F = 4.62, df = 5, 35, p < 0.005$) and the main effect for subjects ($F = 3.45, df = 7, 35, p < 0.01$) were significant. Of great interest is the fact that a trend analysis of the sessions effect revealed a highly significant linear component ($F = 18.94, df = 1, 35, p < 0.001$) which reflects a consistent trend in the direction of more lenient self-imposed performance standards across the six sessions. Further, it may be noted that a linear trend best describes changes in self-determined standards across sessions, as the source of variance that represents a composite of all deviations from a linear trend (quadratic, cubic, *etc.*) did not approach significance ($F = 1.04, df = 4, 35$, *n.s.*).

DISCUSSION

The present investigation provides the first clear demonstration of the effectiveness of contingent reinforcement in a situation in which performance standards were self-determined. No attenuation of the efficacy of contingent reinforcement occurred when performance standards were self-determined rather than externally imposed. The effectiveness of contingent reinforcement when performance standards were self-determined was apparent on the time-at-task variable as well as on the measure of number of correct problem solutions. The superiority of the *EI* condition relative to the *NR* condition came as no surprise; the response maintenance properties of externally managed reinforcement systems have long been recognized. Thus, the results of the present experiment are consistent with the findings of Glynn (1970) but not those

of Lovitt and Curtiss (1969). The superiority of self-imposed contingencies reported by Lovitt and Curtiss (1969) was not observed in the present investigation.

An interesting finding in the present study was the fact that on measures of percentage of problems solved correctly and rate of correct problem solution, there were no significant differences among the means of the three experimental conditions. Although total work output was greater for subjects in the SD and EI conditions, NR subjects were just as accurate and efficient in rate as these children during time spent in the task setting. In other words, it appears that contingent reinforcement affected children's persistence on the task, but not their accuracy or rate.

One of the purposes of the present experiment was to examine the replicability of Bandura and Perloff's (1967) finding that individuals may respond in a manner that fails to maximize reinforcement. The procedure employed by Bandura and Perloff (1967) permitted children in the self-management condition to modify their self-imposed standards only once. Ten subjects were observed to switch to a more lenient standard, six subjects chose a more rigorous performance requirement, and four subjects made no change in their self-imposed standards. Bandura and Perloff (1967), focusing upon the children who imposed austere performance demands, suggested that negative self-evaluative consequences may have resulted from performance that these children judged to be of low quality. However, in the present study in which children were permitted to modify their self-imposed standards up to five times, subjects were observed to self-impose progressively more lenient standards over sessions. At the start of the final session, six of the seven children who were tested selected the most lenient standard.

An interesting fact noted by the experimenters was that 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. It is possible that fewer than five children would have chosen the most stringent performance standard in the first session if the point system had been more clearly understood.

Some differences between results obtained by Bandura and Perloff (1967) and those observed in the present investigation may reflect differences in procedure. In the present experiment, highly attractive prizes and their point exchange values were displayed before the subjects in the contingent reinforcement conditions. Presumably, a child could pick an attractive prize as his goal and then attempt to earn it. In the Bandura and Perloff (1967) study, in which subjects were tested only once, prizes apparently were not openly displayed nor were they delivered until after the study was over. As mentioned earlier, Bandura and Perloff (1967) treated the promise of reinforcement as though it were the receipt of reinforcement, a practice that fails to assess properly the effects of contingent reinforcement. On the other hand, after the first session of the present study, children experienced the administration of reinforcement, and could clearly anticipate the acquisition of additional reinforcers upon reentering the task setting. As the experiment progressed, subjects discovered that no external aversive consequences would follow self-imposition of lenient reinforcement criteria. For this reason, the repeated testing of subjects over a number of sessions proved highly appropriate for determining the manner in which self-imposed performance standards change over time. In summary, the present data indicate that individuals may strongly tend to self-select lenient performance requirements in the absence of social surveillance. This may be especially true when reinforcers of high magnitude are available, as well as in situations in which persons can discriminate that no externally administered aversive conse-

quences will follow the self-imposition of lenient performance demands.

Self-management can serve as a practical and effective alternative to external control in naturalistic settings. Future research might fruitfully be devoted to the elucidation of functional relationships between controlling stimuli and the behavioral components of self-control. In particular, too little attention has been paid to "setting conditions", such as instructions and incidental modelling cues. It would be of interest to replicate and extend the findings of the present experiment by observing the effects of withdrawing contingent reinforcement following behavior maintenance under conditions of self-determined and externally imposed performance standards. In commenting on factors maintaining patterns of self-reinforcement, Bandura (1971) noted that in everyday life, stringent standards may be sustained by intermittent external consequences. It would be interesting to determine the conditions under which occasional disapproval of lenient standards is effective in maintaining adherence to austere self-imposed performance demands. Behaviors that comprise self-management (*e.g.*, self-instruction, self-recording, self-evaluation, self-administration of reinforcement) require clear definition and further exploration.

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