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ABSTRACT

Two studies were conducted to clarify the role of different minimum performance standards for contingent tangible reinforcement or self-dispensed evaluative reinforcement (in the absence of tangible rewards) in determining the rate and accuracy of learning. Preschool children were presented with a discrimination learning task. Their performance had to meet low (few correct), medium, or high (all correct) standards to be rewarded. In an accelerating standard condition their performance had to surpass that on the previous trial. In one experiment, rewards were externally dispensed tokens, while in the second, children self-administered verbal evaluations ("I'm doing real good!"). Learning was significantly more rapid in the high and accelerating standards, and the self-dispensation of evaluative reinforcement produced such rapid learning that by the end of the experiment, effects due to different standards had vanished. Results are discussed in terms of the incentive values of differing standards and the power of self-dispensed evaluative reinforcement. (Author/BRT)

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Achievement Standards, Externally Dispensed Tangible Reinforcement, and Self-dispensed Cognitive Reinforcement as Determinants of Children's Learning

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Running Head: Achievement Standards, Self-reinforcement and Learning

Abstract

Little is known about the ways in which achievement standards affect children's learning, nor is there any information concerning the capability of self-dispensed task evaluation (e.g., pride, self-criticism) to control the acquisition of new behavior patterns. Two studies were conducted to clarify the role of different minimum performance standards for contingent tangible reinforcement or self-dispensed evaluative reinforcement (in the absence of tangible rewards) in determining the rate and accuracy of learning. Preschool children were presented with a discrimination learning task and their performance had to meet low (few correct), medium, or high (all correct) standards to be rewarded. In an accelerating standard condition their performance had to surpass that on the previous trial. In one experiment rewards were externally dispensed tokens, while in the second, children self-administered verbal evaluations ("I'm doing real good!"). Learning was significantly more rapid in the high and accelerating standards, and the self-dispensation of evaluative reinforcement produced such rapid learning that by the end of the experiment effects due to different standards had vanished. The results are discussed in terms of the incentive values of differing standards and the power of self-dispensed evaluative reinforcement.

Achievement Standards, Externally Dispensed Tangible Reinforcement, and Self-dispensed Cognitive Reinforcement as Determinants of Children's Learning

In the study of children's learning, primary attention has been given to the wide variety of external factors which may affect the speed and accuracy with which children learn (Stevenson, 1971). Currently, however, we know little about the ways learning may be affected and subjected to self-regulation by such important factors as internalized achievement standards or related self-control processes such as ongoing self-evaluations and contingent self-reinforcement.

It has been clearly demonstrated that children may readily acquire minimum performance standards by the observation of models (Bandura & Kupers, 1964; Bandura, Grusec & Menlove, 1967; Bandura & Whalen, 1966; Mischel & Liebert, 1966) or instructions (Mischel & Liebert, 1966), and the utility of self-reinforcement processes related to such standards for regulating achievement-related behaviors such as task persistence or learning has recently come under systematic investigation (Bandura & Perloff, 1967; Masters & Santrock, Note 1). Bandura & Perloff (1967) provided a clear demonstration that the self-administration of tangible reinforcers is an effective mechanism for the maintenance of effortful behavior, no less so than externally dispensed reinforcement. Masters & Santrock (Note 1) have shown that very young children's positively or negatively valenced ruminations and evaluations can control persistence at a task whether it be motor or cognitive. Masters & Christy (1974) have demonstrated that by the middle elementary school years children have internalized rules for relating various task parameters to culturally appropriate levels of self-reward such that long or difficult tasks elicit greater self-reinforcement.

These studies provide a reasonably comprehensive picture of the self-reinforcement processes that may come to govern the maintenance of diverse behavior patterns, including the self-dispensation both of tangible reinforcers and of ones more cognitive and affective in nature such as feelings or self-evaluations of pride or self-criticism. These latter self-regulatory mechanisms are particularly likely to be highly trans-situational since they depend less on the contextual environment than on the socialized judgmental standards held by the individual himself.

The fact that self-regulatory mechanisms may play a broad role in the maintenance of effortful behavior patterns strengthens the likelihood that self-dispensed reinforcing and punishing consequences may also provide a self-regulatory function for the acquisition of new skills and behavior patterns. The same achievement standards for self-reinforcement that foster the maintenance of behavior may also determine the course of acquisition for that behavior, just as schedules of contingent reinforcement have both acquisition and maintenance effects. However, despite a growing literature on the effects of performance standards and self-reinforcement for the maintenance of behavior (Bandura & Perloff, 1967; Masters & Santrock, Note 1), there is no information regarding the effects of such standards on children's learning.

The present studies were designed to explore the effects of externally and internally imposed achievement standards upon children's learning and to determine whether self-produced contingent evaluations of ongoing learning performance would affect the rate and accuracy of such learning. The initial study was necessary in order to determine the effects of differing standards of excellence, since there was no prior information concerning the effects on learning of minimum performance standards for contingent reinforcement. Tangible rewards were dispensed to four-year-old children during a

discrimination learning task following trial blocks on which their performance met a low, medium, high, or accelerating standard. There were twelve problems within a trial block, and children in different conditions were rewarded if they achieved a minimum of four correct in a given block, eight or more, all twelve, or one more correct than the maximum they had achieved on any previous trial block. A total of nine trial blocks were presented, and children's performance was scored according to the number of problems they correctly identified in each block. Predictions were tenuous because there was little in the way of empirical or theoretical bases. It was reasoned that lower standards would reduce the incentive for further task mastery once the standard was achieved, since better performance would not result in greater reinforcement. Thus it was expected that learning would proceed best on the high and accelerating standard conditions, less well in the medium standard condition and least well in the low standard condition.

In a second study, children were presented with the same learning task and subjected to the same manipulations of minimum performance standards before reward could be dispensed, but the reward was an intangible performance evaluation that was self-dispensed ("I did very good!"). It was predicted that learning would follow the same course in the various conditions as had been revealed in the first experiment.

Method

Subjects. For both experiments, four- and five-year-old children from nursery schools in a large metropolitan area served as subjects. All were white and came from middle-class families. Two male university students served as experimenters.

For each experiment there were four girls and four boys in each of four experimental conditions. The discrimination task proved particularly

difficult for children of this age and it was decided to exclude any child who showed no evidence of learning over the nine trial blocks. This was felt to be a conservative procedure that would allow a contrast of the experimental conditions as they affected the behavior of children who showed at least some minimal degree of learning. Two children were excluded because of failure to understand the experimental instructions.

Learning task. The learning task consisted of three three-choice color discrimination problems involving differently colored triangles, squares, and circles. Each problem was presented four times within a trial block consisting of twelve trials, and their order was kept constant. The three stimuli were presented horizontally on a gray background-card, and their relative positions on the card were altered randomly from one presentation to the next.

A child's cumulative performance in a given trial block was registered and displayed for him on a "tower of lights," a column of twelve rectangular lights. Every correct discrimination resulted in the illumination of an additional light on the tower. The performance standard in effect for a given child was indicated by a brightly colored band encircling the tower so that when the standard was attained the lights were illuminated up to the band.

Experimental conditions. For each experiment there were four conditions. In the Low Standard condition the band was set just above the fourth light on the column, and a child had to achieve at least four correct discriminations out of the 12 in a trial block to earn any reward (see below). In a Medium Standard condition the band was placed above the eighth light, and in a High Standard condition it was placed above the very top (twelfth) light. In the Accelerating Standard condition the band was initially placed above the fourth light, but following the first trial block the band was repositioned to represent a standard that was one more correct than the maximum the child had

achieved during the preceding trial blocks. At the end of a trial block the child's performance was reviewed by consulting the tower of lights and the reward was or was not dispensed as appropriate.

General procedure. Children were brought into a small experimental room where the experimenter showed them the discrimination task stimuli and demonstrated the tower of lights. The task was explained to the children and they were told that whenever they selected the shape of the correct color a light would come on. At this point the reward procedure was introduced, and the instructions diverged slightly for the two experiments.

For Experiment I, children were told that whenever their performance over a trial block surpassed the indicated standard, they would receive a token that could be exchanged for a prize, and the more tokens they earned the better a prize they would get. During the learning task, individual discrimination problems were presented with a ten-second interval. After each correct response the experimenter praised the subject and turned on a light, while after each incorrect response he said nothing. Following the completion of a block of problems, the experimenter counted aloud the number of correct responses from the tower of lights. If the subject had reached the standard, he was given a token. If the child's cumulative performance had not met the standard, the experimenter said, "That's not enough for a chip." The lights were then reset to zero and the next trial block commenced.

For Experiment II, children did not receive tangible rewards but were to praise themselves whenever their performance had met or surpassed the standard. At the end of each trial block children were asked to talk into a tape recorder microphone, telling the number they had gotten correct and whether they had achieved the standard. If the standard had been achieved, a child was to say, "I did very good!", and if the standard had not been met he was to say, "I

didn't do very good." Initially, these sentences were prompted by the experimenter, but typically after two or three trials children evaluated their performance spontaneously and accurately. To reduce the influence of the experimenter's presence, in Experiment II a screen was placed next to the tower of lights so the experimenter could not see it, and this was emphasized to the child. Furthermore, during the self-reinforcement periods the experimenter made a point of closing his eyes and covering his ears.

In both experiments a session was terminated when the child either performed perfectly for two consecutive trials or when he had completed nine full trial blocks. At this point children's tokens were stored for future redemption (Experiment I), they were thanked for their participation, and they were asked to refrain from telling others in the nursery school the details of their experiences until everyone had been given an opportunity to participate.

Results

Experiment I: Effects of various performance standards on learning: Externally dispensed tangible reinforcement.

The primary data for this experiment were the number of discriminations correct during each of the nine trials. These data are depicted in Figure 1.

Insert Figure 1 about here

The data were subjected to an analysis of variance in which the primary factors were sex of child, experimental condition and trial block. Only the main effects for condition and trial blocks and their interaction proved significant.

The main effect of trial blocks indicates that children's accuracy in correctly identifying correct items improved significantly as they worked at the task ($F = 53.00$, 8/192, $p < .001$): The main effect of conditions indicates that children's learning, averaged across all trial blocks, differed among the

various experimental conditions ($F = 7.47$, 3/24, $p < .01$). Children in the low standard condition performed more poorly ($M = 5.51$) than children in any of the other three conditions ($M = 7.72$, 9.01, and 9.41, in the medium, high and accelerating standard conditions, respectively, $p < .05$ for all comparisons). This effect is qualified by the significant interaction, however.

The interaction between conditions and trial blocks ($F = 2.42$, 24/192, $p < .001$) was clarified by analyzing the data for condition differences on trial block 1, before learning began; on trial blocks 4-6 (averaged), halfway through the task; and on trial blocks 7-9 (averaged), as task work was terminated. The data were the mean number of items correct (maximum of 12) on a single trial block. Analysis of the trial 1 data revealed no significant effects, indicating that children in all groups performed equally poorly prior to training. For the mid-task data (trials 4-6) there was a significant conditions effect ($F = 5.50$, 3/24, $p < .01$). Individual group comparisons revealed that children in the low standard condition performed more poorly ($M = 5.58$) than children in any other condition ($M = 8.00$, 9.58, and 10.46 for the medium, high and accelerating standards, respectively, $p < .05$ in all instances). For the trials 7-9 data, there was also a significant conditions effect ($F = 9.09$, 3/24, $p < .01$), and follow-up comparisons revealed that the effect of conditions that had appeared midway through the task continued to characterize the data at the end of the learning period and children in the low standard condition performed more poorly ($M = 6.83$) than children in any other condition ($M = 9.75$, 11.58, and 11.96, respectively, $p < .05$ for all comparisons). Children in two of the groups (high and accelerating standards) had essentially mastered the task.

Experiment II: Effects of various performance standards on learning: Self-dispensed evaluative reinforcement.

Analyses of these data were similar to the ones reported for Experiment I, and the data are depicted in Figure 2. Children's learning in this experiment proceeded extremely rapidly in all conditions and it was only midway through the task that any condition differences were apparent. An overall analysis of variance revealed a significant main effect of trials ($F = 59.90$, 8/192, $p < .001$) and other predicted group differences were tested using *a priori* comparison techniques (Winer, 1962). Analyses by trial blocks indicated that all

Insert Figure 2 about here

groups performed similarly on Trial 1, but by Trials 4-6 a marginally significant conditions effect was evident ($F = 2.56$, 3/24, $p < .10$). *A priori* comparisons revealed that at this point children in the low standard condition ($M = 8.28$) were performing more poorly than children in either the high ($M = 10.50$) or accelerating ($M = 11.42$) standard conditions ($p < .05$ for each comparison), but their performance did not differ from that of the children in the medium standard condition ($M = 9.50$) as had been the case in Experiment I. For the terminal trials of the task (7-9), analyses indicated that children were all performing with nearly perfect accuracy, regardless of experimental condition, and any prior condition differences were eradicated (mean number correct across all conditions=11.30). It is noteworthy that in Experiment II children's performance by trial blocks 4-6 ($M = 9.93$) nearly equalled that of children in Experiment I after 7-9 trial blocks ($M = 10.03$) and clearly surpassed the level of mid-task performance found in the first experiment ($M = 8.41$).

Discussion

The various incentive conditions created by different minimum performance standards exercised clear control over children's rate of learning, especially so when tangible rewards were associated with the achievement of the standard. Despite widely varying standards, the degree of discrepancy between a child's current performance level and the minimum performance standard did not appear to influence rate of learning. The possibility had been considered that children would learn more poorly for the high standard, at least initially, simply because it was so much above their current performance level and so many nonreinforced trials would be required before learning had progressed sufficiently to allow performance accuracy to meet the standard. It had also been speculated that children's rate of learning might decrease as their performance level approached or surpassed the minimum standard and that learning might proceed no further once a sufficient number of items were correctly mastered to guarantee reinforcement on all subsequent trials. Neither of these possibilities materialized. Even for children in the low standard condition learning occurred when it was unnecessary to insure further reinforcement. In the medium standard condition, despite a slight plateau in learning rate just before the standard was reached (Experiment I only) learning continued even after the standard was surpassed and all trial blocks were rewarded.

All children received accuracy feedback, so information concerning correct or incorrect responding cannot be responsible for differential learning in the various conditions. The number of reinforced trial blocks also cannot account for the differential learning in the different groups. Children in the accelerating standard condition were reinforced following essentially many trial blocks as were children in the low standard condition, but the accelerating

standard produced more rapid learning. Children in the high standard condition received few if any contingent rewards following trial blocks (NONE until trial blocks 8 and 9) but they learned as well as children in the accelerating standard condition who were reinforced regularly and often. The concepts that seem most appropriate for explaining these data are those of expectancy and incentive. Expectancies were clearly established when the contingencies were explained to the children, in the forms of rules relating performance on a trial block to the occurrence of reinforcement. Given the differential standards embodied by the various contingencies, children in those conditions for which improved performance over successive trial blocks was most clearly related to the receipt of reinforcement showed the most rapid and consistent learning. Children in the low standard condition almost immediately demonstrated a level of competence that would guarantee them reinforcement following every trial block even if no improvement occurred. The learning that did occur may then be linked to accuracy feedback in the absence of any external incentive for improvement. Children in the medium standard condition were faced with an incentive to improve their learning until they reached the standard (which was higher than their initial performance), but the incentive vanished after that point. Thus, for a portion of the task period they worked under incentive conditions and for a portion they did not. Their performance was better than that shown by children in the low standard condition, but not so good as that shown by children in conditions where the incentive for improved performance remained in effect even longer: the high and accelerating standard conditions.

One may speculate, then, that accelerating standards and standards that are set at perfect mastery of a task would generally produce similar rates of learning because both maximize the duration of incentive conditions for improved performance. There are some differences between these types of standards,

however. Perhaps the primary difference is that the accelerating standard--at least as operationalized in the present experiments--is nearly always attainable (so long as the problems at hand are solvable), while there are certainly tasks at which one can improve but which can never be mastered perfectly. The present analysis would lead to the prediction that once an individual becomes aware that his task performance will never reach a set standard, the incentive functions of that standard would cease, while for the same task an accelerating standard would continue to maximize learning rate until the limitations of the individual prevented further mastery. Related to this is the possibility that the incentive function of a high standard would be diminished or even reversed (producing a reduced rate of learning) when it is so high that attainment appears impossible (even if that is not actually the case) or so distant that learning would be unrewarded for an extremely long period of time. These hypotheses await empirical test.

Although the results of the two experiments generally agreed regarding the differential effects of the various achievement standards, there were some important differences. Perhaps the most striking was the more rapid and complete learning produced by all standards when they resulted in verbal self-evaluative reinforcement as opposed to tangible rewards. Children in the second experiment eventually demonstrated equivalent mastery of the task, despite the different standards, and their eventual performance was nearly perfect, while only two conditions in the first experiment produced similar results. With respect to the incentive effects discussed above, the data are not incompatible, but they offer some important qualifications related to the way differential achievement standards may operate when learning is largely being self-regulated by evaluative judgments. The only point at which condition differences were at all in evidence was midway through children's work

on the task, but this was also the only point in this experiment where children's actual performance relative to their standards was at all similar to the performance of children in the first experiment. Children in the medium standard were performing only slightly above their standard and had just reached the point where incentive for improved performance had vanished, while children in the low standard condition had long since passed that point and children in the other two conditions had not quite achieved their standard.

What is remarkable about the second experiment, though, is the fact that children continued to master the task rapidly even after their standard had been achieved and improved performance would not change the likelihood of reinforcement. Even by the middle trial blocks children in the low standard condition had shown enough additional improvement to prevent their performance from being significantly different from children in the medium standard condition (as had been found in ExperimentI). Thus it appears that self-dispensed evaluative reinforcement following different achievement standards produces incentive effects prior to the point where a standard has been reached, but children then evidence continued learning that is still greater than that achieved with accuracy feed-back and tangible rewards. One conclusion might be that the value of evaluative reinforcers may generally be greater than that of tangible ones. While this seems reasonable, there is no evidence in the present experiments to indicate that this was in fact the case and children certainly seemed pleased to receive their token rewards. It is also possible that the content of the evaluation, "I did real good," has been related to continued improvement in children's natural socialization within our culture, such that a continued constant level of performance on a learning task, which is cleanly a <u>learning</u> task, does not merit the label, "good": only improvement does. This hypothesis could be tested by investigations of the sort used to

identify task parameters that are linked to self-reward (Masters & Christy, 1974). In the present case it would be predicted that consistently improved performance even beyond a minimum achievement standard is an additional parameter of taskwork, besides simply reaching a PRESET minimum performance level, that is deemed worthy of increased self-reward.

The present experiments have demonstrated clearly that children's self-dispensed performance evaluations may exert a powerful and effective control over their rate of learning, and that the minimum achievement standards for either tangible or evaluative reinforcement also determine the growth of learning. These results have overtones for the acquisition of both cognitive and social skills, although at present only cognitive tasks have been utilized. Future research might well move into the area of determining the effects of competency standards and judgmental abilities for the acquisition of social skills that may be acquired through means other than trial and error such as the observation of a model. The developmental implications of the present results also remain to be assessed.

Reference Note

1. Masters, J. C., & Santrock, J. W. Studies in the self-regulation of behavior: Effects of contingent cognitive and affective events. Unpublished manuscript, University of Minnesota, 1975.

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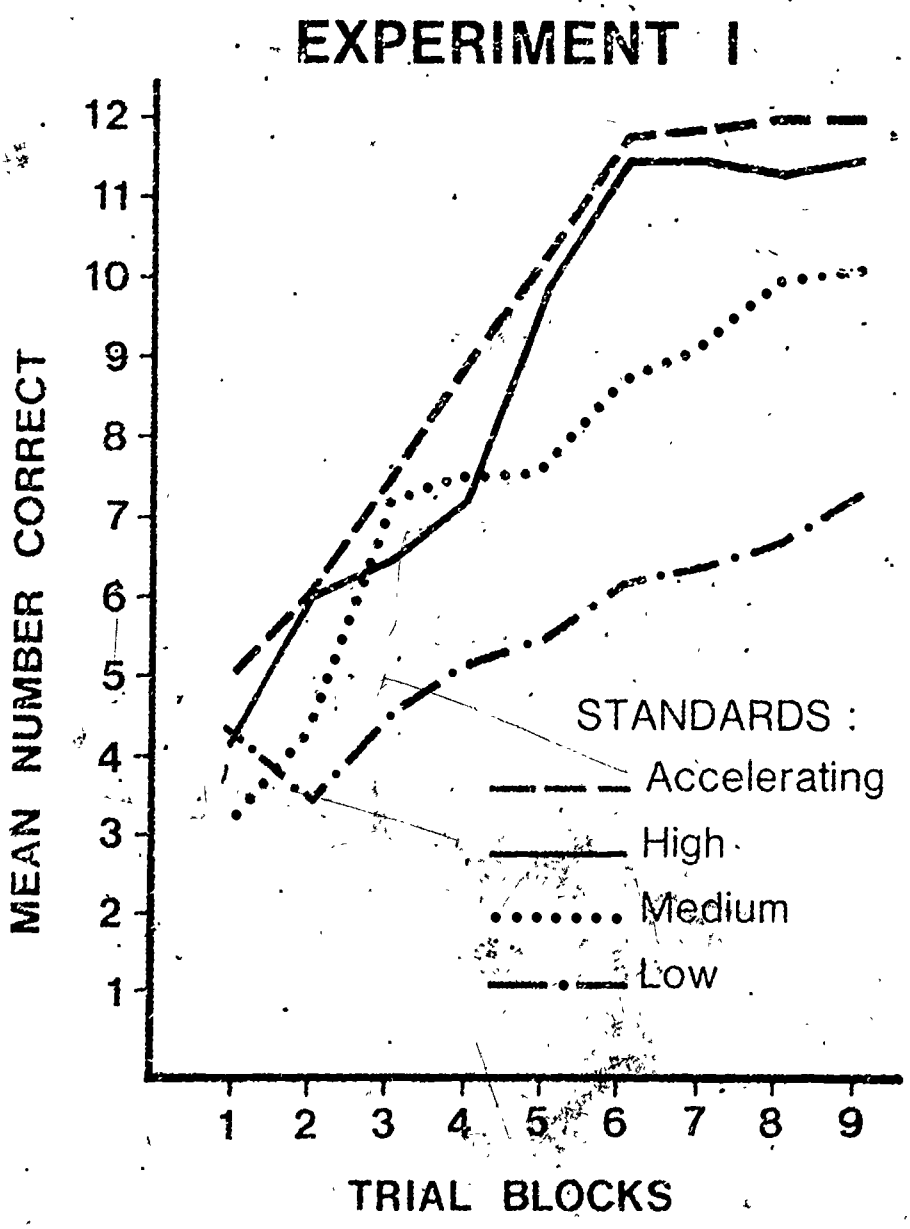
Figure Captions

1. Children's learning as a function of low, medium, high, and accelerating achievement standards for externally dispensed tangible reinforcement.
2. Children's learning as a function of low, medium, high, and accelerating achievement standards for self-dispensed evaluative reinforcement.


EXPERIMENT I
MEAN NUMBER CORRECT
12
11
10
9
8
7
6
5
4
3
2
1
STANDARDS :
Accelerating
High
Medium
Low
1 2 3 4 5 6 7 8 9
TRIAL BLOCKS

EXPERIMENT II