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EFFECTS OF SELF- AND EXTERNALLY IMPOSED REINFORCEMENT (MATERIAL AND SOCIAL) ON INTELLIGENCE TEST PERFORMANCE OF ABOVE-AVERAGE *IQ* CHILDREN*

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SUMMARY

This study investigated the effects of different reinforcement conditions on intelligence test performance. Middle- and upper-class boys and girls (N = 47, $\overline{X}$ age = 10 years 4 months) of above-average intelligence ($\overline{X}$ *IQ* = 115.66) were randomly assigned to one of four treatment conditions: viz., material or social externally or self-administered reinforcement. Form A of the Peabody Picture Vocabulary Test constituted a pretest baseline measure, while Form B, administered a week later, served as the dependent variable. A 2 × 2 (Source × Reinforcement) covariance analysis yielded no significant differences or interactions. Performance standards were investigated, and it was noted that these were more stringent in material than social reinforcement conditions. A significant positive correlation was found between lenient standards and increased test performance in the former, but not the latter.

A. INTRODUCTION

Several studies on diverse populations have assessed the effects of different reinforcers on standardized test performance. However, not all the results support the efficacy of external reinforcement (ER) in this situation

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(e.g., 5, 7, 23). Moreover, Roth and McNamis (18) found that when tested on the Block design subtest of the WAIS, retarded adults were less accurate when every correct response was reinforced than *S*s receiving no reinforcement. In a later study investigating the effects of contingent, noncontingent, and no reinforcement on different levels of *IQ* (viz., low, middle, and high), only the scores of lower-*IQ* children increased on receiving contingent reinforcement (8).

Studies demonstrating a significant increase in *IQ* contingent on some ER have nevertheless been reported (e.g., 1) with average and below-average *IQ* children. Such contradictory results are not surprising, as Smeets and Striefel (21) reported that immediate reinforcement boosted test scores more than end-of-session, delayed, or noncontingent reinforcement, a factor which varied in the above studies.

None of these studies, however, investigated the effect of self-reinforcement (SR) on test performance, a variable which may be important for a number of reasons. First, it is likely that individuals self-reinforce in the standardized test situation, regardless of the presence or absence of a tester. Ignoring this possibility might thus result in an incomplete description of the parameters operative in this situation. Secondly, SR is a necessary component (together with self-monitoring and performance standard setting) in the proposed three-process feedback loop that is held to constitute the self-control paradigm (15). Finally, a number of studies demonstrated that SR is at least as effective as ER in a variety of different situations. For example, Johnson (14) reported no significant differences between the performance of children receiving externally administered or self-imposed reinforcement on a series of simple match-to-sample problems. Similarly, no significant differences between SR and ER were found on a boring, intellectual task (22), in the learning of history and geography material in the classroom (12), or in the rate of academic response (14). Nonetheless, Lovitt and Curtiss (16) reported SR to be more effective than ER on a pupil's academic response rate, although the difference was not significant. Furthermore, Bolstad and Johnson (6) reported that self-regulation was more effective in decreasing disruptive behavior than external regulation, but again the differences did not attain significance.

Research has also been conducted on performance standards as a moderator variable in the self-regulation of behavior. First, the acquisition of performance standards has been investigated. In such studies, the individual either (*a*) observes a model perform a task and then self-reinforce (e.g., 4) or (*b*) is given a number of standards from which to choose, with the opportu-

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nity to change this choice during the experiment (e.g., 10). Bandura and Perloff (4) reported that children often set extremely stringent performance standards; Felixbrod and O'Leary (10) maintained that when children were given the option, they continually imposed less stringent performance standards.

The present study therefore compared the effect of both SR and ER on intelligence test performance, using material and social reinforcement. The latter comprised verbal praise as the effects of symbolic and evaluative reinforcers have received comparatively little attention in the SR literature (3). In addition, the relationship of the performance standard set (moderator variable) and the test results (dependent variable) were investigated.

B. Method

1. *Subjects and Setting*

Forty-seven middle- and upper-class white schoolchildren (21 boys and 26 girls), aged between 9 years 8 months and 11 years ($\overline{X}$ age = 10 years 4 months; $SD = 4.18$) participated in the study. All *S*s were 5th grade pupils at the same school and scored above 100 ($\overline{X} = 115.66$; $SD = 10.7$) on the New South African Group Test (17) administered five weeks previously.

*S*s were tested on both occasions while seated at desks opposite the tester, in the school hall. On both occasions conditions were identical with one exception. On the posttest, *S*s in all groups were isolated from each other, and were thus unaware of the other testing conditions.

2. *Experimental Procedure*

Under a randomized block design, *S*s were assigned to one of four treatments on the basis of their *IQ* scores. Four third-year, male psychology students were used as testers. They were randomly assigned to treatment groups five days prior to the pretest (Form A), when they received instructions and role-playing on test administration. However, individual instruction was given prior to the posttest (Form B) to ensure that all testers were unaware of the other treatment conditions. Each tester received R12.00 (about $15.00) for the testing, and remained unaware of the *S*s' *IQ* scores which were calculated by the *E*s.

Form A of the Peabody Picture Vocabulary Test (PPVT) (9) was individually administered to *S*s in each of the four groups. The test manual instructions were followed except that no approval or encouragement was given following any item as this would constitute noncontingent reinforcement, which has been shown to increase *IQ* test performance (8). Scores obtained

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for each of the four groups during the pretest session served as both a baseline measure and a control for possible time effects of familiarity with test format. One week later, *S*s were retested in the same order on Form B of the PPVT, during which each group was subject to one of the following experimental treatments.

Group 1: ER/material ($n = 11$). In this condition, *S*s were given the same instructions for both pre- and posttests. During the posttest, however, the tester gave each *S* a "Smartie" (candy similar to an M&M) whenever an item was answered correctly. The Smarties thus constituted the external reinforcers.

Group 2: ER/social ($n = 12$). *S*s again received the same instructions as for the pretest. Further, when an item was correctly answered, the tester immediately reinforced the *S*, saying either: "Well done," "Good work," "Keep it up," "That was clever," or "Very nice."

Group 3: SR/material ($n = 12$). *S*s were again given the same instructions as in the pretest. In addition, they were told:

> In front of you there is a bell. Now every time you get an answer correct, I am going to ring the bell. Ringing the bell thus means that you have got an answer correct.[2] You may then take, if you want it and feel you deserve it, one Smartie from the bowl in front of you.[3]

For this treatment, the tester recorded the total number of items correct, as well as the number of self-reinforcements.

Group 4: SR/social ($n = 12$). *S*s again received the same instructions as for the pretest with the following addition:

> You may then, if you want it and feel you deserve it, press any one of the five buttons in front of you. Each button pressed will switch on a light, which will show you something.

Each one of the five buttons illuminated one of the verbal statements used by the tester in Group 2. The tester again recorded both the number of correct items the *S* chose to self-reinforce and the total number of correct items.

3. *Apparatus*

The following equipment was used. (*a*) Forms A and B of the PPVT. (*b*) For both the self-imposed and externally administered material reinforcement conditions (Groups 1 and 3), a transparent dish full of Smarties was

[2] Up to this point, instructions are the same, verbatim, for Groups 3 and 4.

[3] *S*s were thus not required to monitor their behavior. Rather, accurate feedback was provided by the tester, which would lead to self-evaluation. On the basis of this evaluation, SR would follow.

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placed between the tester and the *S*. (*c*) To signify a correct response to *S*s in the SR conditions (Groups 2 and 4), a dinner bell, placed next to the tester, was rung. Both bells used were identical. (*d*) For the social SR condition, a plexiglass box (15 cm × 5 cm × 8 cm) was placed facing the *S*s. On front of the box were five switches, each controlling a red, translucent screen 1.6 × 1.8 cm. When one of the five buttons was pressed, a light went on behind the corresponding screen, further illuminating one of the following statements: Well done, Good work, Keep it up, That was clever, or, Very nice.

C. Results

Table 1 contains the means and standard deviations for pre and posttest data as well as change scores for each of the four treatment conditions. No significant differences were found between any of the four groups ($F = .96$; $df = 3/43$; $p > .05$) on the pretest measure. A 2 × 2 covariance analysis was then performed with the pretest score as the covariate, which yielded no significant Source [i.e., self or externally administered ($F = 1.15$; $df = 1/46$; $p > .05$)], Reinforcement [social or material ($F = .12$; $df = 1/46$; $p > .05$)], or Interaction ($F = .43$; $df = 1/46$; $p > .05$) effects.

In the two SR conditions (Groups 3 and 4), the difference between the pre and the posttest scores was correlated with an index of the performance standard set: viz., Performance Standard Index = (Number of self-reinforcements ÷ Number of correct items) × 100, by means of Spearman's rank-order correlation coefficient (for $N > 10$). In the material SR condition a significant correlation was found between increased performance on the

TABLE 1
Means, *SD*s, and Number of *IQ*s Increased and Decreased for Pretest, Posttest, and Change Scores for the Four Groups

Measure	Material reinforcement				Social reinforcement			
	$\bar{X}$	*SD*	Number inc.	dec.	$\bar{X}$	*SD*	Number inc.	dec.
External reinforcement								
Pretest	107.6	12.1			110.4	13.3		
Posttest	117.6	16.9	9	2	123.8	15.8	11	1
Change	10.0	12.5			13.4	9.4		
Self-reinforcement								
Pretest	113.8	14.1			104.2	16.0		
Posttest	121.8	13.9	8	4	112.0	22.0	8	4
Change	7.4	13.3			7.5	12.2		

Note: inc. = increased; dec. = decreased.

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dependent variable and lenient performance standards ($rho = .51; p < .05$). However, no relationship between social SR and performance standards ($rho = .13; p > .05$) was found, correcting for tied ranks (20).

D. Discussion

Results from this study support previous findings (11, 12), as no statistically significant differences were found between SR and ER. However, the tendency found in other studies for SR to be marginally more effective than ER was not replicated (see Table1), as both material and social ER produced a slightly greater increase than SR.

A number of factors might account for these contradictory findings. Unlike the present investigation in which reinforcement was delivered immediately, previous studies (e.g., 5, 10, 22) made reinforcement available on completion of the study, a factor which may differentially affect SR and ER. Furthermore, delivery of ER has been yoked to SR treatment conditions (e.g., 4, 10) thus making ER noncontingent; in contrast, the continuous, contingent ER in the present study was compared to the *possibility* for continuous, contingent SR, the results of which suggest the importance of continuous, contingent reinforcement, whether externally or self-administered. The number of times a child self-reinforced relative to the ER condition might have been reduced by the presence of a tester. However, five of the 12 children in the social SR group imposed the most lenient performance standards (i.e., they self-reinforced each correct response) thus limiting the cogence of this possibility in the social SR condition. It can also be seen, however, that a third of the scores in the SR condition, one in the material ER, and two in the social ER groups decreased. The issue thus arises whether all individuals are capable of benefitting from SR.

Nonetheless, some children in the SR condition evidenced an increase in *IQ*. It is likely that should their test performance attain a required standard, the individuals bestow some reinforcement on themselves. Therefore, the understanding of SR processes in the standardized test situation may be as important as ER.

Bandura (2) points out that two different research processes are required for a complete understanding of the SR process. The first involves an examination of how performance standards are acquired (e.g., 4). The second, examined in the present study, investigated whether such standards are related to, or influence performance in any way. In the material SR condition, comparatively stringent performance standards were set, in that 11 of the 12 children self-reinforced less than half the items responded to correctly.

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Nonetheless, a significant positive relationship was found between the pretest-posttest change scores, which indicates that lenient standards are related to increased change scores. Thus performance standards *per se* might not necessarily affect performance. Rather, the frequency with which the individual self-reinforces might be the important variable: i.e., the schedule of reinforcement.

On the other hand, no significant relationship was found in the social SR condition. An interesting issue nevertheless arises in that five of the 12 children receiving this treatment self-reinforced each correct response thus imposing the most lenient performance standards. This contradicts Bandura and Perloff's (4) statement that individuals tend to set performance standards that do not lead to maximum reinforcement. Felixbrod and O'Leary's (10) criticism that Bandura and Perloff's *S*s set stringent performance standards as they did not understand the token exchange system seems justified by the present study in which possible misunderstandings were eliminated by using immediate SR. The findings with respect to social SR therefore support those of Santogrossi, O'Leary, Romanczyk, and Kauffman (19), Hildebrandt, Feldman, and Ditrichs (13), and Felixbrod and O'Leary (10) that children tend to adopt lenient performance standards when given the opportunity. Furthermore, previous studies report lenient performance standards only in the absence of the *E*. However, children in the material SR condition generally set more stringent performance standards. The reinforcement available might thus influence the performance standard set, an hypothesis requiring further investigation.

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