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ABSTRACT

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STUDIES IN LEARNING POTENTIAL

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Abstract

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THE EFFECTIVENESS OF A GROUP TRAINING PROCEDURE ON THE RAVEN LEARNING POTENTIAL MEASURE WITH CHILDREN FROM DIVERSE RACIAL AND SOCIOECONOMIC BACKGROUNDS[1]

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The purpose of the study was to determine whether a group training procedure was effective in improving performance on the Raven Learning Potential (LP) measure by intellectually average students from heterogeneous socioeconomic and racial backgrounds. A previous investigation (Corman & Budoff, 1973a) with 202 first through fifth grade white students demonstrated that training these students in groups was as effective in improving their performance on the Raven measure as the individual training which had been given in prior studies of learning potential. On the basis of these findings, a group training procedure was employed in the present study and the possible differential effectiveness of this procedure by race or social class was examined.

Method

The sample consisted of 379 first through fifth grade students in an urban area of upstate New York. Four classes from each of the five grade levels were selected from two elementary schools, one in a low socioeconomic district and one in a middle class community which bussed in large numbers of black students. Fifty-three percent of the sample was black. Twenty-eight percent of the students' fathers were employed in business or professional occupations; the majority were blue collar or clerical workers. Intelligence test scores were not available for these students; mean s ores on standardized achievement tests, however, indicated that students in all grades were performing below grade level in reading and math, and that the discrepancy between average performance and national norms became progressively greater from second to fifth grade.

At the beginning of the study, Sets A, AB, B of the Raven Progressive Matrices were group administered to students in each classroom, one class at a time with the standard instructions (Raven, 1965). At this time each student's sex and race were recorded, and his father's occupation, birthdate, and achievement test scores were obtained from school records. On the basis of scores attained at this test administration, each student was assigned to one of two groups: a group which received training on the Raven test or a group which received no training and served as a control group.

The assignment procedure for all students in each classroom was as follows: Raven scores of all students in any one class were rank ordered from low to high. In the event of tied scores a rank position for the two scores was randomly assigned. The two students with the two lowest scores constituted a block, and each student within this block was randomly assigned to one of the two groups. Each of the two students with the two next lowest scores was then randomly assigned to one of the two groups. This procedure was repeated for each block of two students until all students had been assigned to the two groups. Students in one classroom who were assigned to the training group were trained together, so that training groups originally contained nine to thirteen students. Because of absenteeism, however, actual group sizes ranged from six to thirteen; students who were absent from either training session were deleted from the sample in an effort to avoid distortion of the random assignment procedure.

All students were trained and posttested on Sets A, AB, B within two weeks after pretests had been given. In order to allow older students to demonstrate improvement following training (i.e., to remove a possible ceiling effect on the test), third through fifth grade students were given Raven Sets C and D in addition to Sets A, AB, B on the posttest. Maximum possible scores, then, were 36 on the pretest for all students, 36 on the posttest for first and second graders, and 60 on the posttest for third through fifth graders.

A training booklet which contained nontest problems dealing with pattern completion, orientation of elements within a pattern and double classification problems was distributed to each child. The trainer presented the problems on 2 X 2 slides from a Kodak Carousel projector on a blackboard. The students were required to draw in the missing element for the design and mark the appropriate choice from the six choices presented on the lower half of the page. For the double classification problems, it was found that children could easily derive one attribute at a time but often did not hold the first attribute in mind while they derived the second relevant attribute. During development of the training procedure, the child's understanding was facilitated by having him draw the relevant attributes, one at a time, as he derived them. This helped concretize the elements of the solution process so that many children, after this type of practice, could do the double classification problems mentally with very little trouble. The requirements of each problem type were presented in meaningful designs initially, e.g., an American flag with a piece missing, and then a geometric form to attune the child to the basic format of the Matrices test problems. Individual children were called to indicate the correct choice, and to give reasons for their choice. A slide with the answer included allowed them to compare their choice and to correct it, if necessary. Three scores are derived--pre- and posttraining score, and posttraining score adjusted for pretraining score.

A stepwise multiple regression equation was performed with posttest score (R2) as the dependent variable. Six independent variables were entered into the equation in the following order: (a) pretest score (R1), (b) Age, (c) Sex (coded 1 = male, 2 = female), (d) SES rating of father's occupation on the Turner (1964) scale (coded 0 = on welfare to 9 = managerial), (e) Race (coded 1 = black, 2 = white), (f) Training Group (trained coded 1 or control coded 2). Partial correlation coefficients of two-way interactions involving these variables, when the six effects had been entered into the equation, were also obtained.

Results

Pretest and posttest means and standard deviations of the two groups in each grade are presented in Table 1. The table indicates that the randomized blocking procedure for assigning students to groups was highly effective in equalizing the initial means and variances of the groups. In the total sample, the mean of the control group rose 8.2 points from pretest to posttest, probably as a result of practice in taking the pretest, while the mean increase of the trained group was 10.9 points. The steady rise of pretest scores from first to fifth grade suggests that ability to do the Raven problems increases with age. The marked difference in means on the total posttest between second and third grades reflects the fact that third through fifth graders received the 60 item test.

TABLE 1

Means and Standard Deviations of the Two Groups

by Grade on Raven Pretest and Posttest

		R1 (A,AB,B)		R2[a]		R2 (A,AB,B)		
Grade	Group	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	N
1	trained	16.73	5.87	21.24	6.69	same as R2		33
	control	16.76	6.22	18.59	6.08	same as R2		41
2	trained	20.03	6.62	24.46	6.89	same as R2		35
	control	20.90	5.78	21.38	6.39	same as R2		39
3	trained	23.58	5.45	37.25	8.94	26.39	5.53	36
	control	24.14	5.16	36.20	8.96	26.07	4.87	44
4	trained	26.03	6.63	41.65	11.50	28.08	6.83	40
	control	25.46	5.90	39.20	12.06	27.30	6.75	46
5	trained	26.90	6.32	43.57	8.52	30.10	4.35	29
	control	26.94	4.40	41.00	8.26	27.97	4.06	36
Total	trained	22.68	7.16	33.63	12.48	26.03	6.78	173
sample	control	22.84	6.56	31.08	12.67	24.21	6.76	206

[a]Grades 3, 4, and 5 were given Sets C and D in the post-training administration in addition to Sets A, AB, B.

Table 2 presents the results of the stepwise multiple regression equation on posttest scores. Pretest score (R1), Age, SES, and Training Group were all significantly related to posttest scores ($p < .001$). The negative sign of the beta weight of the Training Group factor indicated that subjects in the trained group performed significantly better on the posttest than students in the control group. Older students or students from middle class backgrounds attained higher posttest scores than younger students or students from lower SES backgrounds. Posttest scores were not differentially affected by race or sex. The percent of variance accounted for by all variables in the equation was 73.8, with 20.8% attributable to pretest score; the multiple r^2 was .738 ($F = 170.79$, 6/364 df, $p < .001$).

Inspection of the partial correlation coefficients between posttest scores and the 15 two-way interactions, after main effects had all been entered into the equation, indicated that the following interactions were significant: R1 X Age ($r = .198$, $p < .01$), R1 X SES ($r = .148$, $p < .01$), Age X SES ($r = .209$, $p < .01$), and SES X Training Group ($r = .123$, $p < .05$).

Plots of these interactions provided supplementary information to that revealed by the significant main effects: middle class students attained higher posttest scores, particularly if they had high pretest scores or were older. The significant R1 X Age interaction indicated that older

TABLE 2

Results of Multiple Regression on Raven Posttest Scores

Variable	Beta	T-test	*df*
R1	.592	16.99*	364
Age	.350	11.23*	364
Sex	.028	1.02	364
SES	.114	3.73*	364
Race	.016	0.57	364
Training group	-.095	-3.52*	364

$r^2 = .738$

$F = 170.79$, $df = 6/364$*

*$p < .001$

students with high pretest scores got high scores on the posttest.

The SES X Training Group interaction was of particular interest. Table 3 presents the Raven pretest and posttest means for trained and nontrained subjects in three social class groups, when social class ratings on the Turner Scale (1964) were trichotomized into low (welfare, unskilled, or semi-skilled), middle (skilled or clerical), and high (business or professional) levels. The table indicates that the discrepancy in posttest mean gains between the trained and nontrained groups was greatest in the middle and high SES ranges. There was almost no difference in posttest mean gains between the trained and nontrained low SES groups. Even without training, the low SES students increased their mean scores to the levels of their trained low and middle income peers.

Discussion

Perhaps the most important findings of this study were that the training procedure was successful in improving students' nonverbal reasoning ability as measured by the Raven Progressive Matrices, and that the training was equally effective with black and white students. Sixty-five percent of the black students were from low SES backgrounds, compared to 49% of the white students in the sample. The partial r for the Race X Training interaction on posttest

TABLE 3

Mean Raven Scores of Trained and Nontrained Subjects in Three Social Class Groups

		Trained			Nontrained		
		X̄	SD	N	X̄	SD	N
Low SES	R1	20.41	6.75	63	21.85	6.44	88
	R2	29.60	11.95	62	30.47	11.90	86
	difference	9.19			8.62		
Mid SES	R1	21.32	6.62	19	22.50	6.35	20
	R2	30.68	13.62	19	28.32	12.98	19
	difference	9.36			5.82		
High SES	R1	28.03	6.56	37	27.32	5.21	37
	R2	42.11	10.93	37	39.06	11.74	36
	difference	14.08			11.74		

scores was not significant before SES was entered into the equation. Therefore, the lack of differential training effects by race was not the result of a confound between race and social class. The finding that males often attained higher Raven scores that has emerged in previous studies with special class students (Corman & Budoff, 1973b; Corman & Budoff, 1973c) was not found with this sample.

The significant social class effect and SES X Training interaction obtained with this sample were not obtained in a prior investigation (Corman & Budoff, 1973a) which compared the relative effectiveness of group and individual training procedures with students in the same age range as this sample. While the prior sample consisted almost entirely of white students, their mean and standard deviation on the Turner Social Classification of Occupations Scale was very similar to the sample in this study. Despite this similarity in socioeconomic composition of the samples in the two studies, the previous investigation found training to be equally effective with students of different SES levels. With the present sample, however, training was found to be more beneficial to students from middle and high SES backgrounds.

One may more meaningfully assess the impact of the training by examining the relative standing of the lower SES students prior to and following training vis-a-vis the pretest scores of the middle class children. The premise is that the pretest levels of the middle class child represent a criterion for good school and test performance. Learning potential assessment compensates for the middle-class children's lifelong spontaneous acquisition by providing the low income child by providing experiences that equip him to deal more adequately with the reasoning task at hand. One intent of a training-based assessment is to diminish the competence gap between more and less privileged groups.

The investigators set the criterion for effectiveness of the training at the proportion of low income students who attain the pretest level of their more privileged agemates following training. Lower class was defined as 0 to 4 on the Turner Scale (welfare, unskilled, skilled blue collar, or clerical), and middle class as 5 to 9 (business and professional). On the pretest, only 15% of the lower class students reached or exceeded the pretest mean of the middle class students at their age level; on the posttest, however, 40% of the lower class students attained scores as high or higher than the middle class pretest mean.

Babad and Budoff (in press) and Corman and Budoff (1973d) reported similar findings with a different nonverbal reasoning task (a series test) which was administered in the testtrain-retest paradigm. Babad and Budoff (in press) included samples of students from special classes for the educable mentally retarded (IQ < 80), and those with IQs in the 80 to 100, and 100 plus ranges. Sixteen percent of the educable mentally retarded sample fell at or above the pretest means of the dull normal sample (mean IQ difference was 17 points), and 36% exceeded this pretest mean after training. With the bright normal group as criterion for the EMRs (there was a 45-point difference between the mean IQs of the two groups), none of the EMRs reached the bright normal mean in the initial test; 13% exceeded it following training. Eleven and 35% of the dull normal group attained the pretraining mean of the bright normal group prior to and following training, respectively.

Corman and Budoff (1973d) reported that 51.3% of their low income normal sample exceeded the middle class pretest mean. What is notable in this study is that the low SES sample was largely black (approximately 80%) and the contrast middle SES students lived in affluent white communities in western Connecticut.

Providing low SES students with experience with the problem-solving styles commonly acquired spontaneously by middle class students clearly minimized the usual SES effect for a significant proportion of these students, when the task is nonverbal reasoning problems. In the three studies this effect was minimized with less than one hour of group-administered training. Even when the comparisons are made with posttraining scores in the present study, the SES main effect only accounts for 1% of the variance. A learning potential assessment procedure which provides equalizing experience by including task-relevant training within the assessment process shows promise of being a culture fair means of assessing ability to profit from experience, i.e., intelligence.

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Footnotes

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