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ABSTRACT

Eighteen mentally retarded children were selected for study because they exhibited low levels of skills in sitting, eye contact on command, and following other commands. Ten other children were selected because they showed high levels of those skills. High skill Ss were found to have higher scores on the Peabody Picture Vocabulary Test. Training ten low skill Ss to give eye contact, decrease out of seat behaviors, and follow other commands resulted in IQ increases. Very large changes in basic learning skills were found to be associated with far smaller, though important, changes in IQ. (CL)

Effects of Basic Learning Skill Training on Peabody Picture Vocabulary Test Scores of Severely Disruptive, Low Skill Children

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Researchers have periodically reported increases in intelligence test scores as a function of motivational increases induced by the conditions under which the test was administered including positive reinforcement for correct answers (Ayllon & Kelly, 1972; Edlund, 1972; Smeets & Striefel, 1975) though some negative observations have also been published (Clingman & Fowler, 1975). The reader is referred to Smeets and Striefel's (1975) introduction which contains a comprehensive discussion of studies conducted over the past 62 years that have produced IQ changes.

While much has been written about increasing intelligence scores through motivational increases, little has been written about increasing intelligence scores through skill increases. The behaviors of sitting, eye contact on command, and following commands are necessary skills if a student is to provide valid psychological test results and to benefit from most classroom instruction. Cobb (1970) and Cobb and Hops (1972) have labeled these behaviors "survival skills" thus indicating their prerequisite nature. Staats (1968) has also discussed the importance of the prior establishment of such behaviors

before effective teaching can be achieved. The purpose of the prersent study was to investigate the extent to which intelligence test scores obtained from the Peabody Picture Vocabulary Test are increased by shaping the behaviors of sitting, eye contact on command, and following commands to a high level in severely disruptive low skill children.

Method

Subjects

Eighteen low skill and ten high skill subjects participated in all aspects of this study. Thirty-four children from five to nine years of age were initially selected from among 150 children attending a school for retarded children. Twenty-four of the children were considered to be severely disruptive and of low skill by their teachers. These children were also chosen because they exhibited less than 50 percent correct responses on two of three behaviors involving sitting, eye contact on command, and following other commands and not more than 60 percent correct responses on the third behavior. The remaining ten children were selected because they were considered to be high skill students by their teachers and they exhibited at least 90 percent correct behaviors involving sitting, eye contact on command and following other commands. Two experimental and four low skill control subjects dropped out of the experiment for reasons of ill health or their family moved. This left a total of ten

experimental and eight control low skill subjects plus ten high skill children.

Setting

The students were enrolled in a special school for retarded children conducted by an institute associated with a medical school. The treatment was administered in a single classroom within the school. All testing was conducted individually in a quiet room.

Response Definition

Sitting. This behavior was defined as the percent of 12 second intervals over a 10 minute period that the child's posterior remained in contact with his or her chair while he or she was engaged in a task while seated at a table. A plus was entered on a data sheet if the child's posterior remained in contact with the chair for the full 12 second period. Otherwise a minus was recorded. The number of pluses over 50, the total number of 12 second periods in ten minutes, defined the percent of sitting behavior.

Eye contact on command. The experimenter sat opposite the child at a table and spoke the child's name and then asked the child to "look at me". If the child made eye contact the trial was scored correct; otherwise the trial was scored incorrect. The request to "look at me" was repeated 15 times during the testing session and the number of times the child made eye contact was divided by 15 to obtain the percentage of eye contact on command.

Following other commands. This category is comprised of four behaviors asked of the child five times each while the experimenter was working one-to-one with the child. While standing, the child was asked to sit down and a plus was recorded if compliance occurred within five seconds. The child was asked to "look at the book", when not attending to it, on five occasions during the same one-to-one session. Compliance within five seconds was scored as a plus. The child was also asked to point to a chair in similar fashion. The child was then presented with a randomly ordered set of four squares colored red, green, yellow, and blue; the child was then asked to "point to the red one" and a plus was scored if only the red square was pointed to. This procedure was repeated five times. The total number of plus responses over all five repetitions of each of the four commands was divided by 20 to obtain the percentage of following other commands.

Observational System.

Data sheets were prepared for each of the tasks providing a space for recording a plus if the task was successfully completed or a minus if the task was unsuccessfully completed. All observations were made while the child was engaged in a one-to-one task with the second author.

Reliability

Observer reliability was calculated by dividing the number of trials upon which two observers agreed by the total number of trials upon which two observers agreed or disagreed.

Procedure.

Screening. All subjects were tested once to determine if they scored less than 50 percent correct on two of the three major categories of behaviors discussed above and not more than 60 percent on the third category or if they scored at least 90 percent correct on all three major categories of behaviors. This procedure determined the low and high skill children respectively.

Pretraining baseline. All low skill children were administered the assessment procedures for five consecutive days and the average percent correct for each major category of behavior was calculated. The Peabody Picture Vocabulary Test (PPVT) was individually administered once during this pretraining baseline period.

Experimental groups. The low skill children were divided into twelve experimental and twelve control subjects chosen by pairs such that each pair was of the same sex, had PPVT scores of within 5 months of mental age of one another, and the mean score on two of the three types of behavioral tasks was within 20 percent of one another. The ten high skill children were approximately matched in age to the 12 experimental and 12 control children.

Training. Six children were trained over a five month period. As these children were trained to criterion and returned to their regular classrooms, new children were brought into the experimental classroom and trained for what amounted to a three month period since the academic year was only eight months long. Two of the six "second wave" children dropped out of the experiment for reasons of ill health or their family moved away. Hence, subjects 1-6 received five months of training while subjects 7-10 received three months of training.

The children attended school five days a week and received learning skill training daily on an individual basis. The first priority for all the children was the elimination of disruptive and out-of-seat behaviors through the use of time-out procedures. Each child was placed in a time-out booth, if one was available, or held by hand in a chair until he or she was quiet for a minimum of one minute whenever disruptive or out-of-seat behaviors occurred. Such time-out procedures were employed throughout the training phase to maximize the effectiveness of training.

The training focused on the establishment of eye contact once the disruptive and out-of-seat behaviors were brought under control. During spontaneous eye contact training, a child was reinforced with candy during each 20 second interval that he or she made contact with the trainer's eyes; social reinforcement was given as well. The child received eye contact on command training once

their rate of spontaneous eye contact exceeded 70 percent. The trainer began by placing the primary reinforcer at his eye level when calling the child's name. The trainer gradually lowered the primary reinforcer to his nose, chin, and then out of sight completely as he called the child's name. Thus, the child gradually learned to respond to his or her name and not to the primary reinforcement. The reinforcement schedules were gradually shifted from continuous reinforcement to fixed ratio and then to fixed interval schedules. The criteria for changing these schedules was maintenance of 90 percent correct responses on the learning skill for at least five consecutive days.

Similar procedures were utilized for the following of commands training. The behaviors of sitting, looking at a book, pointing to a chair, and pointing to a red square on command were trained in no special order. Reinforcement was initially continuous for gradual approximations of the desired response. Reinforcement was then given on a fixed ratio and fixed interval basis as training progressed.

The experimenter met weekly with the teacher and aides to review the program effectiveness and make joint decisions regarding changes in schedules and in target training. Each child's progress during the week was reviewed and the effectiveness of the training was evaluated. By analyzing the graphs of each target behavior for each child, the experimenter was able to be continuously involved with and facilitate the adequacy of training. The criterion used in

deceiding when to conclude the training phase was the maintenance of 90 percent correct responses on all target learning skills for a period of five consecutive days.

Posttraining. The PPVT was individually administered as soon after the training was concluded as feasable.

Follow-up. The six children who were trained first were retested at least three months later when the academic year ended and the "second wave" children were receiving their posttesting.

Results

Reliability

Observational training preceeded the entire experiment and concluded when the percentage of agreement was consistently above .85. Periodic spot checks indicated that reliability was maintained throughout the experiment.

High vs. Low Skill Children

The first question to be asked was whether children differing in sitting, eye contact on command, and following other commands would differ in their PPVT intelligence test scores. Therefore, a group of low skill children was chosen on the basis of exhibiting low levels of these three behaviors and a group of high skill children was chosen on the basis of exhibiting high levels of these three behaviors. Table 1 displays the first results. Mann-Whitney U tests verify the selection procedures in that high and low skill children differ significantly in their

levels of sitting ($U = 0$, $p < .001$), eye contact on command ($U = 0$, $p < .001$), and following other commands ($U = 0$, $p < .001$). These differences are substantial in addition to statistically significant. The high skill children sat 2.02 times as much as did the low skill children, they maintained eye contact on command 2.97 times as often, and they followed commands 3.72 times as often as did the low skill children. As predicted, the high skill children obtained significantly higher PPVT scores than did the low skill children ($U = 0$, $p < .001$). In fact, the PPVT scores of the high skill children were 3.01 times as great as the PPVT scores of the low skill children. The actual difference is probably even greater as children who were unscorable on the PPVT were given a score of 20 months of mental age which is just one month below the lowest score that can be legitimately earned and hence represents the maximum unearned score. It is quite likely that other intelligence estimates would have placed these children substantially below 20 months of mental age. Hence, it was demonstrated that higher PPVT scores are associated with higher levels of sitting, eye contact on command, and following other commands.

Insert Table 1 about here

Skill Training and IQ Increases.

The second question to be answered is whether or not training methods that produce increases in sitting, eye contact on command, and following other commands would also produce increases in PPVT scores. Low skill children were trained from below 50 percent correct responses on two of the three basic skill behaviors and not more than 60 percent correct on the third behavior to where they equalled or exceeded 90 percent correct on all three basic skill behaviors. The control group consisted of untreated children.

Table 2 verifies the effects of training on the subjects in the experimental group. Pre-post changes were statistically evaluated by first calculating an effective gain index defined as (Post - Pre)/ Pre in order to control for differences in starting values. Mann-Whitney U"s were then calculated for changes in sitting, eye contact on command, and following other commands and found to all be $U = 0$, $p < .001$ since all subjects in the experimental group had larger positive effective gain scores than did the control subjects. It is also clear that the members of the experimental group present at follow-up retained the treatment benefits and that the untreated control subjects changed very little over the same three month time span.

Insert Table 2 about here

Table 2 also reveals increases in PPVT scores associated with the experimental group but not the control group and that these changes are maintained in those subjects available for follow-up testing. A Fisher Exact Probability Test found that the number of subjects in the experimental group showing increases in PPVT scores was significant ($p < .01$). Of greater importance is the fact that six of the ten experimental subjects increased their IQ classification by one level (from profound to severe retardation), and one child increased her IQ classification by two levels (from profound to moderate retardation). Moreover, 4 of the 6 experimental subjects showed higher PPVT scores at follow-up than at post testing. None of the control subjects changed IQ classification at the posttest or at the follow-up test. The same children who were unscorable at the pre and post tests were still unscorable at follow-up.

Discussion

Two approaches to increasing IQ scores now seem apparent. The more common method involves reinforcing correct responses. An alternative method involves training the basic skills of sitting, eye contact on command, and following other commands that are basic to taking standardized tests and to learning in most classroom setting.

The boundary conditions associated with IQ increases due to skill training can be appreciated in the following way. The basic learning skills of the trained subjects were very similar to the basic learning skills of the high skill children. However, the IQ's of the high skill chidren was 2.58 times that of the trained subjects at posttesting and 2.54 times that of the trained subjects at follow-up. Hence, by raising the basic learning skills of the low skill group to that exhibited by the high skill group one does not also equalize their IQ as measured by the PPVT. Hence, very large changes in basic learning skills are associated with far smaller, thought important, changes in IQ.

Reference Notes

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Footnote

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Table 1

Individual and Group Data on Basic Learning Skills and Intelligence Test Scores of Low and High Skill Children

Subjects		Sitting	Eye Contact on Command	Following Other Commands	PPVT (a)
	1	60.20 (b)	34.00	18.00	20.00 (c)
	2	40.11	32.63	35.71	20.00
	3	48.20	38.20	7.00	20.00
	4	33.27	12.56	24.38	26.00
	5	31.79	26.13	10.00	20.00
	6	60.70	41.75	27.86	22.00
	7	52.80	40.00	34.00	20.00
Low	8	61.17	5.40	31.00	20.00
	9	47.20	18.60	25.00	20.00
Skill	10	27.40	50.60	57.00	21.00
	11	58.60	41.40	50.00	23.00
	12	52.20	2.80	16.00	20.00
	13	43.60	54.60	14.00	20.00
	14	25.60	29.40	3.00	20.00
	15	63.20	44.00	39.00	20.00
	16	55.80	22.80	23.00	20.00
	17	50.80	49.40	37.00	24.00
	18	41.80	49.20	15.00	20.00
	M	47.47	32.92	25.94	20.89
	SD	12.02	15.53	14.55	1.75
	1	92.40	100.00	93.33	90.00
	2	94.80	100.00	92.00	62.00
	3	98.00	100.00	100.00	92.00
	4	100.00	93.20	100.00	71.00
High	5	94.00	100.00	100.00	58.00
	6	99.60	100.00	100.00	99.00
Skill	7	94.40	100.00	100.00	36.00
	8	96.40	100.00	96.00	39.00
	9	96.00	92.00	94.00	45.00
	10	93.60	93.20	90.00	36.00
	M	95.92	97.84	96.53	62.60
	SD	2.58	3.49	3.95	24.04

(a) Scores are in months of mental age.

(b) Scores are in percent.

(c) Twenty months of mental age was credited to each unscorable subject.

Table 2

Pre, Post, and Follow-Up Data for Experimental and Control Subjects on Basic Learning Skills and the PPVT Intelligence Test (a)

		Sitting			Eye Contact On Command		
Subjects		Pre	Post	FU	Pre	Post	FU
	1	60.20b	98.40	100.00	34.00	96.00	100.00
	2	40.11	100.00	100.00	32.63	100.00	93.00
	3	48.20	95.20	100.00	38.20	98.00	100.00
	4	33.27	96.40	96.00	12.56	96.00	80.00
	5	31.79	94.80	94.00	26.13	98.00	93.00
	6	60.70	97.00	100.00	41.75	96.00	93.00
Exp.	7	52.80	100.00		40.00	100.00	
	8	61.17	98.80		5.40	98.00	
	9	47.20	100.00		18.60	99.17	
	10	27.40	99.67		50.60	99.17	
	M	46.28	98.03	98.33	29.99	98.03	93.17
	SD	12.67	2.03	2.66	14.17	1.59	7.31
	11	58.60	68.25	82.00	41.40	16.88	36.50
	12	52.20	23.00	22.00	2.80	3.50	10.00
	13	43.60	36.00	37.00	54.60	53.10	50.00
	14	25.60	8.25	16.00	29.40	23.38	27.00
Cont.	15	63.20	60.67	71.00	44.00	31.87	33.80
	16	55.80	40.13	41.40	22.80	19.53	19.90
	17	50.80	50.00		49.40	46.80	
	18	41.80	24.75		49.20	28.50	
	M	48.95	38.88	44.90	36.70	27.95	29.53
	SD	11.84	20.22	26.43	17.36	16.11	13.90

Table 2 (Cont.)

Subjects		Following Other Commands			PPVT (c)		
		Pre	Post	FU	Pre	Post	FU
	1	18.00	95.00	90.00	20.00	20.00	23.00
	2	35.71	97.00	95.00	20.00	23.00	25.00
	3	7.00	94.00	85.00	20.00	23.00	23.00
	4	24.38	99.00	90.00	26.00	23.00	25.00
	5	10.00	95.00	90.00	20.00	26.00	23.00
	6	27.86	96.00	95.00	22.00	25.00	29.00
Exp.	7	34.00	97.50		20.00	26.00	
	8	31.00	96.00		20.00	23.00	
	9	25.00	95.83		20.00	23.00	
	10	57.00	100.00		21.00	31.00	
	M	26.99	96.53	90.83	20.90	24.30	24.67
	SD	14.23	1.87	3.76	1.91	2.95	2.34
	11	50.00	34.38	47.50	23.00	21.50	22.00
	12	16.00	13.38	17.50	20.00	20.00	20.00
	13	14.00	10.00	12.50	20.00	20.00	20.00
	14	3.00	1.25	10.00	20.00	20.00	20.00
Cont.	15	39.00	36.33	37.00	20.00	20.00	20.00
	16	23.00	22.67	21.50	20.00	20.00	20.00
	17	37.00	37.00		24.00	24.00	
	18	15.00	6.25		20.00	20.00	
	M	24.63	20.16	24.33	20.88	20.69	20.33
	SD	15.83	14.41	14.81	1.64	1.44	0.82

(a) Twenty months of mental age was credited to each unscorable subject.

(b) Scores are in percent.

(c) Scores are in months of mental age.