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ABSTRACT

Cognitive self-instructional (CSI) programs have been successful in improving problem-solving skills in many, but not all, children. The importance of understanding the influence of subject characteristics in self-control studies, while often ignored in actual research, has been repeatedly advocated verbally. This paper presents a study designed to explore and confirm the relevance of subject characteristics such as language level, attribution of personal causality, and relationship with the therapist to CSI training outcome. In a treatment analogue study, 15 children received CSI training and 15 were in an attention control group. The children, aged 72 to 139 months, were from a non-clinical population attending a summer day camp. Each child participated in a subject measure assessment, pre- and post-training assessments, and two 20 minute training sessions. Training materials for both groups included tasks which varied in their similarity to the assessment measure. The CSI group improved more than the control group on Porteus Mazes; both groups improved over time on other measures. Cognitive maturity, personal attributions of causality, private speech, and therapist ratings were related for the CSI group to improvement on the Porteus Mazes but not the other measures. These same subject variables, especially the attribution measure, were related for the control group to all outcome measures. Prediction and detection of treatment versus practice effects are discussed. (Author/PH)

Subject Variables in Cognitive Self-Instructional Training

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Abstract

Cognitive self-instructional (CSI) programs have been successful in improving problem-solving skills in many, but not all, children. The importance of directing the most efficacious treatment toward particular groups of children is discussed. In a treatment analogue study, 15 children received CSI training and 15 were in an attention control group. The CSI group improved more than the control group on the Porteus Mazes; both groups improved over time on other measures. Cognitive maturity, personal attributions of causality, private speech, and therapist ratings were related for the CSI group to improvement on the Porteus Mazes but not the other measures. These same subject variables, especially the attribution measure, were related for the control group to all outcome measures. Prediction and detection of treatment versus practice effects are discussed.

Subject Variables in Cognitive Self-Instruction Training

Cognitive self-instructional (CSI) techniques have been used successfully in treating many types of childhood disorders, most notably those that include some impulsivity component (Palkes, Stewart, & Kahana, 1968; Meichenbaum & Goodman, 1971; Meichenbaum, 1977). Based on the work of Luria (1961) and Vygotsky (1962) that children gradually learn to control their motor behaviors through overt then covert verbalizations, these techniques are designed to increase motor and cognitive control by teaching children to instruct themselves while doing problems and tasks. The intervention has undoubtedly been helpful in decreasing the impulsive nature of many children's problem-solving approach (see reviews by Karoly, 1977; Meichenbaum, 1977, 1979; Kendall & Finch, in press). Despite these encouraging reports in the literature, however, those who have actually used CSI programs would probably acknowledge that the treatment works better with some children than others, even when the procedures, therapists, and settings are the same. These "failure" cases may escape recognition by getting lost in group data, by being deleted altogether in case study reports, or by being refused publication. Although parametric studies of treatment, clinician, assessment, and physical surrounding variables have been reported (see Meichenbaum, 1979 for a review), few studies to date have focused specifically on the characteristics of children that might influence their responsiveness to CSI treatment.

The importance of understanding the influence of subject characteristics in self-control studies, if often ignored in actual research, has been verbally advocated repeatedly (Karoly, 1977; Meichenbaum, 1977; Kendall, 1977; Copeland, Note 1; Robertson & Keeley, Note 2). In other areas of behavior/personality research, the interaction of person with situation variables has been debated and discussed at length with the result of a clearer understanding of the importance of individual and environmental differences in determining behavior (Cronbach, 1957, 1975; Bowers, 1973; Mischel, 1973). The goal of investigating the role of subject measures in self-control interventions is to be able to make better prescriptions of treatment by knowing the interactive effects of different interventions with different subject characteristics.

Copeland (Note 1) has reviewed the self-control literature for indications of which subject variables might be importantly related to the success of CSI intervention with impulsive children. Although few of the studies reviewed had subject characteristics as a main focus, enough consistency across studies was found to indicate the most likely variables to influence treatment outcome. These matched what would be theoretical predictions as well. That is, given the reliance of CSI training on verbal self-control, it is not surprising that Copeland (Note 1) found indications of a relationship between responsiveness to CSI training and age, cognitive level, private speech, attribution of causation and therapist ratings of involvement.

Age of subject has been found to be important in planning the type of self-instructions to be taught. Concrete, overt, and explicitly stated instructions appear to be more helpful to younger (6 to 7 years old) children than are more abstract instructions (Meichenbaum & Goodman, 1969; Meichenbaum, 1975; Denny, 1975). Kendall and Wilcox (1980) have systematically explored the efficacy of concrete versus conceptual self-instructions with older (8 to 12 years old) children, finding the conceptual instructions more helpful. There appears, then, to be a shift in optimal treatment strategy as children get older.

A parallel relationship between type of strategy and cognitive maturity has been noted in several self-control studies. Barkley, Copeland, and Sivage (in press) found that more frequent feedback during training was needed to maintain the performance of boys with lower mental ages. Conversely, Schleser, Meyers, and Cohen (Note 3) found that the cognitively less mature children in their study benefited more from the CSI intervention than the more mature ones. In a non-CSI self-control study, Ridberg, Parke, and Hetherington (1971) showed that lower IQ boys responded more favorably to a treatment designed to increase reflectivity of style when a model used several strategies. Higher IQ boys improved more when the model demonstrated one strategy only. Cognitive level clearly influences treatment of self-control. Given that CSI training has also successfully altered the task accuracy of retarded children (Guralnick, 1976; Norton & Lester, 1979; Leon & Pepe, Note 4), the current literature suggests that verbal ability can apparently be matched with different, appropriate levels of self-instruction to maximize CSI treatment effects.

The language developmental level of the children being taught self-control may be significant in another way. It has become clear (Luria, 1961; Kohlberg, Yaeger, & Hjertholm, 1968) that children gradually learn to control their motor behavior verbally. As control is learned, children first accompany their actions with verbalization spoken aloud. These verbalizations become more and more covert as control is mastered, as the child matures. It seems logical, then, to presume that different types of verbal self-control strategies should be taught to children of different language developmental levels. Although these levels are difficult to interpret and assess in each child (see Kendall & Hollon, Note 5, for a review of assessment techniques), there is evidence that children who talk aloud more do better on tasks (Beaudichon, 1973; Murray, 1979; Martin, Note 6). Asarnow and Meichenbaum (1979) found that children who demonstrated the spontaneous use of verbal rehearsal during a pre-training assessment were the ones who improved more regardless of whether they had received CSI training, rehearsal instruction, or mere practice. CSI training was more effective than the control conditions for the non-producers of rehearsal strategies, however. How children of different language levels respond to CSI treatment, then, needs to be more clearly understood.

Another promising characteristic which is a potential influence on children's response to self-control training is their attribution of personal causality. Whether or not children feel that they can control the events in their lives would logically be related to their learning of self-control techniques (Kopel & Arkowitz, 1975). Bugental, Whalen, and Henker (1977) found, for example, that CSI training was significantly more effective than a reinforcement program in improving the Porteus Mazes performance of children who made internal attributions on the causality measure. In contrast, children scoring in the external direction improved more under the reinforcement program. With this empirical and theoretical rationale, then, direction of attributions and CSI training clearly warrant further study.

Finally, Kendall and Wilcox (1980) and Glenwick and Barocas (1979) have noted the importance of the type and quality of therapist-child relationships in determining the success of CSI training. The theoretical reasons for this are probably not specific to CSI training; children with closer or more involved and cooperative relationships with the therapist are probably those who are doing well in treatment. Nevertheless, as they might be early indicators of whether to continue a certain treatment,the meaning of therapist relationships should be more clearly understood.

The current paper presents an analogue study designed to explore and confirm the relevance of these subject characteristics to CSI training outcome. The children were from a non-clinical population, chosen to represent a range of skills and styles, a characteristic considered pertinent in this initial investigation. The use of this sample had the added benefit of enabling the examination of treatment and practice effects in their most basic form, i.e., without the sometimes ambiguous overlay of impulsivity, aggression, or hyperactivity. The goal here was to understand more specifically how CSI training affects different types of children.

Method

Subjects

Thirty children, aged 72 to 139 months, participated in the study. Children were randomly assigned to one of two groups. The experimental group consisted of seven boys and eight girls(M age = 97.9 months, SD = 19.75); the attention control group also consisted of seven boys and eight girls (M age = 95.7 months, SD = 19.28). The groups did not differ in age, $F(1,28)=1.05$, n.s.

The children were from a non-clinical population, those attending a summer day camp. No child was in a special classroom during the school year and none had ever received the label "hyperactive". All children and their adult experimenters were Caucasian.

Procedure

Each child participated in a subject measure assessment, pre- and post-training assessments, and two 20-minute training sessions. The subject measure and pre-training assessments occurred in Session I, the first training period in Session II, and the second training period and post-training assessment in Session III. These sessions took place on the day camp grounds (with the training sessions held in a mobile laboratory) on three different days and were similarly spaced across time (i.e. within 10 days) for all children. Different experimenters administered the subject measure,training, and assessment batteries and were blind to the results and/or conditions determined in the other sessions.

Subject Measures. The subject measures consisted of the following:

1. Personal Attribution - This measure, described in detail by Bugental et al. (1977) is a multiple-choice-type structured interview in which children rate the importance of several causal agents (e.g. effort, luck) for success and failure. Bugental et al. reported data on children's perception of school success and failure. The present study assessed children's perceptions of both school (good and bad grades) and play (winning and losing games). High scores denoted internal attribution. Total grades (the sum of attributions about getting good and bad grades) and total games (for both winning and losing) attributions were used in the analyses.

2. Peabody Picture Vocabulary Test (PPVT) - This visual multiple-choice vocabulary test was given to provide an indication of the children's receptive vocabulary and verbal ability.

3. Information subscale of the Wechster Intelligence Scale for Children - Revised (WISC-R) - This subscale was chosen as the one which correlates most highly with the Full Scale IQ at this age range, and thus was used as a global indicator of intelligence.

4. Observation - During a five-minute solitary free play session, each child was observed and rated on two measures: 1) activity level (a five-point scale, from "completely inactive, just sat" to "extremely active") and 2) amount of vocalization (the number of utterances; phrases spoken aloud, addressed to self or to no one). Both measures had been previously determined to be adequately reliable (over 80%).

Pre- and Post-Training Assessments. The following measures were used to establish a pre-training level of problem-solving style and competence against which change in the post-training period could be determined.

1. Porteus Mazes - In this test, the child is required to solve pencil mazes of increasing difficulty. It is thought to be a good measure of planning ability and of cognitive style. The standard administration was used for this test in both the pre- and post-training assessment. The test age was computed for each child for each administration; in addition the mean number of qualitative errors was counted for each maze.

2. Matching Familiar Figures Test (Kagan, 1966) - This commonly-used test was designed to assess the child's impulsive versus reflective style in solving problems. The child is to chose from among six highly similar drawings the one which exactly matches a sample drawing. Both latency of response and number of errors are measured. The standard MFF was divided into two forms, one consisting of the even-numbered items and the other of the odd-numbered items. One form was given in the pre-training session and the other after training; order was counterbalanced across subjects.

3. Benton Visual Retention Test - The standard administration of this test involves the child's examining a card with several patterns or figures drawn on it then drawing the contents of the card on another paper from memory. An alternative instruction, the one used in this study, directs the child simply to copy the figures with the original still in view. Forms C and E were used, with order of presentation counterbalanced across subjects. Because a child could make more than one type of error on each card according to the standard scoring system, both the total number of errors and the number of correctly drawn cards were computed.

Training Sessions. Each child was randomly assigned to the experimental or the attention control group. In either case, the child met with an experimenter for two 20-minute sessions on different days. The experience of the children in the two groups was identical in all non-treatment-related ways. The experimenter was the same, the amount of practice with the training materials was the same, and the amount and quality (i.e. warmth, valence) of the verbal interaction with the experimenter was controlled as closely as possible.

Training materials for both groups included tasks which varied in their similarity to the assessment measures. Design tracing from the Frostig Developmental Tests of Visual Perception, connect-the-dot drawings, coloring, and matching-sample games were used in the two sessions.

The experimental training followed the basic outline of the CSI treatments in the literature (Meichenbaum & Goodman, 1971). Over the course of the two training sessions, the experimenter first modeled self-guiding statements and then instructed the child to say them, first aloud then whispering and finally silently. These self-instructions followed a basic outline which was visually and verbally presented to the child. An overall re-statement of the goal of the task was the initial step (e.g. "What am I supposed to do here? I'm supposed to connect the dots in the order of the numbers. Then it'll make a picture."). The actual self-instruction of a planned, orderly, and reflective strategy was then taught (e.g. "I should go slowly so I don't goof. Begin at the 1, find the 2 before I move my pencil, slowly and firmly is the best way."). Errors were handled (e.g. "Oops, I made a mistake, but that's o.k. I can just erase that part and try again.") Finally, the performance was evaluated and praised (e.g. "How did I do? Yep, all the numbers are connected in order and it looks like a house. I did really well. Good job!"). Both concrete (e.g. "I should connect the dots.") and conceptual (e.g. "I should keep my mind on this picture.") instructions were taught.

The attention control group was designed to provide the children with similar amounts and types of experiences with the training materials and with an adult experimenter, but with no specific instructions about how to improve their problem-solving strategies. Consequently, the children in this group were exposed to exactly the same training materials as the experimental group, but were allowed to play with them uninterrupted by instructions. Because children performed the tasks much more quickly when they were not self-instructing, and because the number of training materials had to remain controlled across conditions, there was usually extra time left for the children in the control group. They were permitted, at that point, to play any of a number of games which were unrelated to the training or assessment measures (e.g. Lincoln Logs). To continue the control for attention and verbal interaction, the experimenter spoke to and praised the child during this play to a degree similar to that of the experimental sessions.

After each of the two training sessions, the experimenter rated the child on five seven-point scales of involvement and cooperation. These scores were summed to form one therapist rating for each session; a high score denoted a child who was highly involved and cooperative.

Results

A two-way (condition x trial) analysis of variance with repeated measures on the trial (pre- vs post-training) factor was used to determine the effectiveness of the CSI training. Partial correlations between the subject measures and the pre- to post-training change scores, where pre-training scores were controlled, were used to assess the importance of the subject characteristics in determining practice and treatment effects.

In Table 1 are the means and standard deviations of the two groups' subject and assessment measures. As shown, there were no significant differences between

Insert Table 1 About Here

the experimental and control groups on any of the measures.

A summary of the results of the two-way analyses of variance is found in Table 2. Children in both groups performed correctly on significantly more

Insert Table 2 About Here

Benton Visual Retention Test items after training than before training, F (1,28)= 6.03, $p < .025$. Similarly, they made fewer MFF errors after training than before,.

F (1,28) = 4.62, $p < .05$. The significant condition x trial interaction for the Porteus Mazes, F (1,28) = 5.75, $p < .025$, suggests that the two groups responded differently to the repeated assessments. A Scheffé post hoc analysis revealed no significant between-group differences. Examination of the means indicates that before training, the experimental group made more errors (M = 5.61, SD = 2.18) than the control group (M = 4.68, SD = 1.72); this was reversed after training, with the experimental group improving and making fewer errors (M = 4.45, SD = 2.07) than the control group whose performance worsened (M = 5.69, SD = 3.02).

Table 3 contains the partial correlations between change scores and subject measures (with pre-training scores controlled) for both the experimental and the

Insert Table 3 About Here

control groups. Change scores were derived such that a positive score denoted improvement in the desired direction. For example, for the Benton errors measure, the post-training score was subtracted from the pre-training score. For the Benton correct measure, the pre-training score was subtracted from the post-training score. In all cases, a constant value of 100 was added to the sum so that no negative scores were used. Consequently, a positive correlation between a subject measure and a change score in Table 3 denotes that a high value of a subject characteristic is related to improvement from pre- to post-training. Negative correlations mean that children who scored high on a subject measure improved less. To avoid repetition with Table 3, r values are not repeated in the text.

Two general patterns of correlations are notable in Table 3. First, Porteus Maze test age scores were consistently related to subject measures for both groups. PPVT and Information raw scores (data retained because of their absolute value in contrast to the relativity of the IQ or scaled scores), for example, were positively and significantly related to improvement on this measure, i.e., the more verbally mature children in both groups tended to improve more on the test age measure upon repetition of the Porteus Maze test after training. Children who were rated by the experimenter as being more involved and cooperative also were the ones who improved most on this measure. Improvement of the test age scores of the Porteus Mazes was negatively related for the experimental group to the amount of vocalization during the free play observation; children who talked less during play improved more on the Porteus Mazes. It is important to note that this does not imply that children who talked less got higher scores; rather, it means that they improved more over their pre-training score. In fact, the Pearson product-moment correlation between talking during free play and the unadjusted post-training test age score was positive though nonsignificant ($\underline{r}$ = .53, $\underline{df}$ = 14, n.s.). Finally, for the control group only, older children and those who made more internal attributions about how to get good grades were the children who improved more on the test age measure. This latter relationship of grades attribution with test age improvement was similarly but nonsignificantly positive for the experimental group; these children's improvement in learning to make fewer qualitative errors was, however, significantly related to internal grade attributions. In short, then, for both groups of children, many subject measures were significantly related to improvement on the Porteus Mazes, especially as measured by the test age score.

The second interesting pattern to emerge from the partial correlations (Table 3) is that on the Benton Visual Retention test and the MFF, improvement was again positively related to the attribution and intelligence measures for the control group but <u>not</u> the experimental group. Control group children getting higher Information raw scores (more mature but not necessarily brighter in comparison with their age group) improved more on both the latency and error measures of the MFF. Similarly, with one exception, both of the attribution measures were positively correlated with improvement on all of the Benton and

MFF measures for the control group; the games attribution measure was positively but nonsignificantly related to improvement on the MFF errors measure.

Discussion

To summarize, the results show that CSI treatment was more effective than the attention control condition in producing improvement on the Porteus Maze test. The two groups showed similar significant improvement on the Benton and MFF tests after training. Subject measures for both groups were positively related to improvement on the Porteus Maze test but were related to Benton and MFF improvement only for the control group. The significant improvement on these two tests shown by children in the experimental group was unrelated to subject characteristics.

The finding of CSI effectiveness for some but not all outcome measures is fairly common (see reviews by Hobbs, Moguin, Tyroler, & Lahey, 1980; Meichenbaum, 1979). Porteus Mazes have been sensitive to CSI-like treatments in previous research (Hobbs et al., 1980) although why this measure reflected training-related treatment and the other measures did not is unclear. It might be argued that the mazes were more similar to the training tasks used in this study than the Benton and MFF tests were. In fact, however, the training materials included a design tracing and a sample matching task which were somewhat similar to the Benton and MFF tests, and included nothing like a maze task. In this particular study, it might also be argued that, because exactly the same Porteus Mazes were re-administered whereas different forms of the Benton and MFF were used on the pre- and post-training assessments, the results merely reflect a practice effect rather than a strong treatment effect. A more likely pattern of results to be predicted given a practice effect and a weak treatment, however, would be for the measure which was repeated exactly (i.e., Porteus Mazes) to show improvement regardless of training condition (a true practice effect) and for the measures using independent forms (i.e., Benton and MFF) to reflect any differences which existed between experimental and control conditions. In fact, of course, just the opposite was found in this study. The most likely explanation of the CSI-related improvement on the Porteus Mazes is that this test is most amenable to generalization from the self-instructions taught. The Benton may have seemed too easy to the children (although few children got all cards correct) and the MFF, perhaps, too abstract to apply the CSI training. The mazes, on the other hand, provided the experimental group a good opportunity to apply their new skills.

The more important focus of this study is reflected in the partial correlation data. It is interesting in the light of the group differences, to note that only for the Porteus Mazes--only for the one test that revealed a treatment effect--did the subject measures of the experimental group appear related to improvement. This connection must remain somewhat guarded because it was the "qualitative errors" measure that showed a significant treatment effect and the "test age" measure that was primarily involved in the correlations. Nevertheless, improvement as a result of CSI training in this clinical analogue study was significantly related to children's higher cognitive levels (but not IQ or scaled scores), more positive therapist ratings, and less speech during an independent play observation, and tended to be related to more internal attributions about success. It may be, then, that cognitively more mature, more involved and cooperative, and more "internal" children profit more from CSI training. These conclusions make clear theoretical sense, in that CSI training is based on the use of verbal strategies to teach children that they can help themselves. Children more advanced in the rudiments of these skills would be expected to learn the new strategies more quickly and easily.

The negative relationship found between improvement and speech during play is difficult, for theoretical reasons, to interpret. Children who talked less improved more. But whether these children were less mature (and had not yet begun to control their motor behavior verbally) or more mature (whose verbal control had developed already into the covert stage) is impossible to discern. The latter interpretation is more probable given the other indications of the importance of maturity found in this study, but this remains conjecture. In fact, the opposite conclusion from similar findings was implied by Asarnow and Meichenbaum (1979). Nonproducers of rehearsal strategies were assumed to be less advanced in mediational skills than inconsistent producers. Nonproducers maintained CSI training effects more than comparison training effects, whereas inconsistent producers improved regardless of training condition. The implication, then, was that less mature children improved more. The most likely explanation for differences in patterns of results between these two reports is that Asarnow and Meichenbaum (1979) studied kindergarten children (and presumably less advanced in language control), much younger subjects than in the present study. Clearly, if spontaneous speech (rehearsal) is to be useful as a treatment choice criterion, a more reliable method for assessing the child's developmental level must be derived.

Different reasons for the consistent pattern of correlations between improvement and subject measures must be considered for the control group. Here, where no treatment except attention was given to the children between assessments, such variables as intellectual and verbal maturity, and internality of attributions were significant indicators of improvement. Regardless of whether group means decreased (Porteus Mazes) or increased (Benton and MFF), this relationship was found. It is particularly interesting that when both groups improved similarly, as on the Benton and MFF, subject measures, especially attributions, played a significant role in improvement for the control group but not the experimental group. Apparently, when no intervention is made, it is the characteristics of the children themselves that determine who will improve. When what appears, statistically, to be an ineffective treatment is given, however, children respond similarly regardless of their characteristics. Thus, CSI treatment in this study did have an impact on the children, even when it did not result in significantly greater improvement than that shown by the control group. Although the two groups numerically improved similarly on the Benton and MFF tests, then, they did so for very different reasons.

These results are encouraging for CSI therapists. The intervention was effective in either producing a significant improvement over the control condition or in minimizing the importance of some subject characteristics as they were related to improvement. Because this was functionally an analogue study, with non-clinical subjects and a short intervention, clinical conclusions must await clinical replications. The role of subject characteristics in modulating both treatment and practice effects, however, clearly deserves further examination. An important sequel to this work will be the comparison of several types of self-control treatments with children who vary on the subject measures. The goal is to be able to prescribe the most appropriate intervention for each individual child.

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Table 1

Means and Standard Deviations of Subject Measures

and Pre- and Post-Training Measures

Measure	Experimental		Control		t
Subject Measures	M	SD	M	SD	
Age	97.90	19.75	95.71	19.28	0.27
PPVT raw	66.73	6.96	70.47	8.59	-1.31
PPVT IQ	103.00	11.98	105.50	12.05	-0.50
Information raw	9.20	3.12	8.33	2.97	0.78
Information scaled	10.90	2.13	9.29	2.70	1.57
Grades attribution	3.73	1.88	3.93	2.17	-0.26
Game attribution	3.73	1.71	4.29	2.02	-0.80
Observation vocalization	0.73	0.96	0.80	1.32	-0.16
Observation activity	3.00	1.20	3.33	1.11	-0.79
Therapist Rating 1	4.11	0.62	4.24	0.45	-0.68
Therapist Rating 2	4.41	0.73	4.24	0.54	0.74

Table 1 - Continued

Pre-Training Assessments					
Porteus Mazes					
Test Age	10.77	3.78	10.61	3.98	0.11
Qualitative Errors	5.61	2.18	5.01	1.18	0.91
Benton					
Errors	5.60	5.08	6.36	4.29	-0.43
Correct	5.80	2.76	4.71	2.73	1.06
MFF					
Latency	10.79	4.66	9.61	4.90	0.66
Errors	6.40	3.33	8.86	5.08	-1.55
Post-Training Assessments					
Porteus Mazes					
Test Age	11.93	3.62	10.40	4.24	1.06
Qualitative Errors	4.45	2.07	5.69	3.02	-1.31
Benton					
Errors	5.53	6.57	4.93	4.13	0.30
Correct	6.27	3.15	5.80	3.17	0.40
MFF					
Latency	11.22	5.27	12.83	9.42	-0.58
Errors	5.33	3.44	5.07	3.13	0.22

Note - There were no measures in which the experimental and control groups were significantly different.

Table 2

Summary of Analyses of Variance for

Assessment Measures

Measure	Trial MS	Trial F[a]	Condition MS	Condition F	Trial X Condition MS	Trial X Condition F
Porteus Mazes						
Test Age	10.41	1.12	21.60	<1	1.67	<1
Qualitative Errors	0.08	<1	0.35	<1	17.71	5.75[b]
Benton						
Errors	4.27	1.01	0.27	<1	3.27	<1
Correct	13.07	6.03[b]	13.07	<1	3.27	1.51
MFF						
Latency	69.12	2.42	0.16	<1	44.04	1.54
Errors	68.27	4.62[c]	9.60	<1	17.07	1.16

a In each case, $df = 1,28$.

b $p < .025$.

c $p < .05$.

Table 3

Partial Correlations between Subject Measures and Change Scores, Pre-Training Scores Controlled

	Porteus Mazes		Benton		MFF	
	Test Age	Qualitative Errors	Errors	Correct	Latency	Errors
Age						
E	.33	.01	-.29	-.29	-.17	-.11
C	.56a	-.16	.20	.23	.03	.19
PPVT raw						
E	.72c	.29	.21	.17	.10	.16
C	.76c	.32	.15	.13	.41	.35
PPVT IQ						
E	.24	.13	.33	.28	-.09	.15
C	.29	.47	-.08	-.21	.47	.15
Information raw						
E	.60a	.43	.31	.23	.08	.13
C	.72c	.09	.38	.42	.56a	.55a
Information scaled						
E	-.11	.19	.31	.22	-.24	-.02
C	.20	.41	.17	.26	.46	.37
Grades Attribution						
E	.52	.69b	.54	.30	.41	-.36
C	.56a	.28	.78d	.71c	.67c	.58b
Game Attribution						
E	.49	.45	.53	.42	.22	-.21
C	.00	.31	.61b	.64c	.59b	.43
Observation-vocalization						
E	-.61a	-.28	.41	.38	-.37	-.27
C	-.20	.31	-.19	-.02	-.03	.11
Observation-activity						
E	-.50	-.03	.35	.27	-.07	-.29
C	-.15	.01	-.01	-.05	-.01	.06
Therapist Rating #1						
E	.64a	.46	.03	-.10	-.35	-.09
C	-.05	-.24	-.24	-.04	.05	.31
Therapist Rating #2						
E	.11	.19	.02	.00	-.34	.33
C	.54a	-.20	.06	.11	.36	.43

a $p < .05$
b $p < .025$
c $p < .01$
d $p < .001$