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Two Techniques of Modifying an Impulsive Tempo

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TWO TECHNIQUES OF MODIFYING AN IMPULSIVE TEMPO

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ABSTRACT

Preschool children were administered Kagan's Matching Familiar Figures Test (MFFT) and Caldwell's Preschool Inventory (CPI). Based on MFFT scores, subjects were matched in triplets and placed under one of three conditions; an analytic training condition which emphasized delay and cognitive strategies, a delay training condition which mainly emphasized delay in addition to visual strategies, and a control condition which received no training. Following training subjects were again administered the MFFT and the CPI, and, in addition, they were subjected to a delay of gratification situation.

Results revealed that subjects under both training conditions significantly increased their response times and decreased in errors relative to the control group. Contrary to predictions, training in delay did not generalize to the CPI, an achievement test for preschool children. Training did, however, generalize to the delay of gratification task, resulting in subjects who were trained waiting significantly longer relative to the nontrained group.

TWO TECHNIQUES OF MODIFYING AN IMPULSIVE TEMPO

INTRODUCTION

Reflection-Impulsivity (R-I) has been defined by Kagan (1965) primarily as a conceptual tempo or decision time variable, representing the time the subject takes to consider alternative solutions before committing himself to one of them in a situation with response uncertainty. While reflection is conceived as a unitary variable, for empirical purposes, classification of subjects has utilized a dual criterion (response time and errors) to permit refinement of classification by ruling out small extremes in which either exceptionally high intelligence or exceptionally high fearfulness causes atypical behavior.

Evidence has been accumulated, particularly as measured by the Matching Familiar Figures Test (MFFT), for both the reliability and validity of the R-I construct (Kagan, 1965, 1966; Kagan & Moss, 1962; Kagan, Moss & Sigel, 1963; Kagan & Rosen, 1964; Kagan, Rosen, Day, Albert, & Phillips, 1964).

This construct postulates the cognitively reflective child as less likely than the impulsive child to report wrong solutions; more likely to consider alternative possibilities before committing himself; preferring low risk situations generally but choosing harder, more solitary intellectual tasks; having longer attention spans; and being less distractible, less motorically active, and more cautious than his impulsive age-mate. Moreover, these characteristics appear to be discernible in children in some form as early as infancy, and

they persist, in the context of a trend toward increasing reflectivity with age, through adolescence and beyond.

Individual differences in reflection-impulsivity are evident in children as young as two years, with reflective two year olds showing more sustained involvement with toys than their impulsive peers (Repucci, 1970). Pre-school children (Lewis, 1968), school age children (Kagan, et al., 1964), college students (Drake, 1970), and adults (Yando & Kagan, 1968) all show individual differences on the reflective-impulsivity dimension.

In general, impulsivity and reflectivity are observed by using the MFFT, whereby a standard stimulus is selected from an array of similar stimuli. Kagan (1965), in several studies of young grade children, has found that: (1) response latencies decrease with age, (2) there are consistently high negative correlations between response latencies and number of recognition errors in discrimination tasks using geometric designs or familiar objects, and (3) decision times on these tasks are orthogonal to traditional intelligence test scores. Kagan advances the idea that there is a dramatic decrease in errors and a corresponding increase in response time over the age range 5 to 11 years. It seems that at every age there is a negative relation between response time and errors, ranging between -.40 and -.65 (Kagan, 1965, 1966).

There is evidence for the consistency of this disposition in that the tendency to be reflective or impulsive generalizes from task to task. The correlation between response time on the MFFT and response time on a Haptic-Visual Matching task were consistently high across many samples of children (Kagan, 1965; Kagan, et al., 1964). Comparable correlations have been reported for kindergarten children (Ward, 1968).

However, in a study by Eska and Black (1971), findings revealed no generalizability of conceptual tempo across different tasks using ten year-old males.

Kagan (1965), in observing school age children's behavior, strongly suggests that there are important sex differences in response to task uncertainty. Lewis (1971), using preschool children, asserts that the hypothesis of sex differences in cognitive style is strongly supported in that he consistently obtained results which indicated that boys' error scores were significantly correlated with their response speed, while girls' errors were significantly correlated only with their intelligence. In a study using different tests of reflection-impulsivity, Ward (1968) observed that across all tests, boys showed a higher correlation between errors and response time than girls, and girls showed a higher correlation between errors and IQ than boys. Similarly, Eska and Black (1971) reported that boys showed a higher correlation between errors and response time than girls.

The correlation between response time and the verbal scale of the Wechsler Intelligence Scale for Children is usually under .20, but it is higher for girls than for boys (Kagan, 1966). Forrester and Noyles (1965) found a moderate positive correlation between MFFT response time and measures of intellectual ability, such as the WISC, Binet, and PPVT among six-year old deprived children. However, in a study using preschool black children, Hargrove and McKenna (1972) found a nonsignificant relationship between the Peabody Picture Vocabulary Test and response time, but there was a significant correlation between MFFT and certain scales of Caldwell's Cooperative Preschool Inventory (CPI), an assessment of preschool achievement.

Lesiak (1970), in investigating the relationship between the reflection-impulsivity dimension and aspects of reading, found that reflective first grade males scored significantly higher than impulsive females in word recognition ability, general reading comprehension, and ability in critical reading. Reflective first grade males differed significantly from impulsive males only in critical reading. More specifically, with verbal ability controlled, the reflective as compared with the impulsive child has been shown to display fewer errors on tasks of inductive reasoning which called for the completion of a sequence according to a logical principle (Kagan, Pearson & Welch, 1966); made fewer errors of recognition in a test where one word presented orally had to be recognized among five written words (Kagan, 1965), and made fewer errors of commission in recalling words in a serial learning task (Kagan, 1966). While reflectivity-impulsivity has been found to correlate significantly with success on some tasks, this is not the case for others such as a paired-associates learning task and a test of motoric inhibition (Mumbauer & Miller, 1970).

How can we conceptualize the psychological bases for this disposition? What are the antecedents of reflection-impulsivity? Kagan (1964) considers three possibilities; constitutional predispositions, involvement in the task, and anxiety over task competence. There is some evidence favoring the idea that excessive motor restlessness and distractibility might be attributed to minimal and subtle brain damage during the prenatal or early postnatal period. Ratings of hyperkinesis during ages three to six were inversely correlated with ratings of involvement in intellectual activity during adolescence and adulthood (Kagan & Moss, 1962).

Research into the antecedents of reflection-impulsivity also indicates that anxiety and fear of failure (Kagan, 1966; Messer, 1970; Massari & Schack, 1971), imitative learning (Debus, 1970; Yando & Kagan, 1968), and reinforcement history (Debus, 1970; Kagan, et al., 1966) may also influence its development.

As many researchers feel that the tendency to be impulsive is often a handicap in the typical school situation, many inquiries have been made into the modifiability of this disposition. In training impulsive children to be more reflective, a brief training in delay produced large response latencies but did not have a strong effect on errors, neither did this generalize to an inductive reasoning test (Kagan, et al., 1966). Wright and Briggs (1968) manipulated reinforcement contingencies so that impulsive subjects were reinforced for lengthened response latencies. They found that this procedure not only increased response time among these impulsive children, but errors increased as well. Bandura (1969) has shown that exposure to social modeling is an effective procedure for altering this disposition. Other findings have shown that a teacher with a tendency to be reflective or impulsive can influence a child's tempo (Yando & Kagan, 1968). Woker (1970), in investigating the effect of teacher tempo on the reading progress of reflective and impulsive boys, hypothesized that more subjects would change in the direction of greater reflectivity if placed in reflective teachers' classrooms than if placed in impulsive teachers' classrooms. This hypothesis was supported for impulsive but not reflective boys. Other investigators have indicated that a cognitive self-guidance program which trains impulsive children to talk to themselves is effective in modifying their behavior (Meichenbaum, 1970). Others have found that brief observation of

several patterns of model behavior produced at least a temporary modification of response times to MFFT items in impulsive subjects (Debus, 1968). Denny (1972) studied modeling effects upon conceptual style and cognitive tempo and found that the performance of his subjects demonstrated that the conceptual style and conceptual tempo of the model changed their styles and tempos and that these effects generalized to independent tasks.

In certain tasks, instructions which contained an explanation of the appropriate task strategy were very effective in reducing errors and lengthening response latencies (Heider, 1971). Ayable (1969) conducted a study in which he postulated that reflectives trained in impulsive problem solving strategy would become more impulsive and impulsives trained in reflective problem solving strategy would become reflective. His results indicated that training in impulsive strategy did indeed induce impulsive behavior but that training in reflective strategy failed to induce reflective behavior. The effects of modeling and verbalizations of strategies in the modification of conceptual tempo was studied by Ridberg (1969). Results indicated that, when considering over-all shifts in style, the impulsive child displayed considerable change after viewing a reflective model. He showed a significant increase in response time with a corresponding significant decrease in errors. Moreover, these changes were stable after a week. The reflective child, on the other hand, was inconsistent in his behavior, for he showed a further increase in response time while also increasing his error rate. Investigators interested in observing strategies employed by reflective and impulsive subjects have usually done so by recording eye fixations or scanning techniques using

an eye-camera. Gardner and Long (1962) defined the high scanner as the subject who scores high on judgement time, number of fixations, number of centrations on standard, percent time on standard, and redundant scanning time. One study revealed reflective subjects as having significantly higher mean scores on all absolute measures of frequency and duration of looking behavior but that reflectives, as compared to impulsives, devoted less looking time as well as less frequent looks to the standard, to the most observed alternative, and to the chosen alternative. Instead, they devoted more time to scanning all possible alternatives. If, as these studies suggest, reflectives and impulsives are using different search strategies, then simply forcing impulsives to delay should not be expected to reduce their errors in a multichoice problem situation. That is, long response time may be a necessary but not sufficient condition for reflective responding.

Although many studies have concerned themselves with conceptual tempo at different age ranges, very little has been done on preschool children, specifically black preschool children. It has been noted by Zucker and Stricker (1968) that disadvantaged children possess very short attention spans and are easily distracted from the task at hand. They found, in comparing the performance of black disadvantaged children in a Head Start program with middle class children, that the lower class children were significantly more impulsive and less accurate than their middle class peers. Lower class children also responded significantly faster, or more impulsively, than a middle class comparison on a variety of verbal tasks. In addition, under a forced-latency condition, where the child was obliged to wait a certain amount of time before responding, the lower class children improved their performance

significantly on these tasks, resulting in their performance being indistinguishable from the middle class group (Schwebel, 1966). Fish (1967) investigated impulsivity in young children from deprived backgrounds who had experienced a well-defined preschool educational intervention program during a two-year period. She hypothesized that preschool intervention would assist in controlling impulsivity. This hypothesis was not upheld.

The present research is directed toward comparing different techniques for relative effectiveness and generalizability. The questions asked are: What are the effects of different training methods? Most importantly, if training affects conceptual tempo, can these effects be observed in other tasks, other than the MFFT, a test devised to assess this concept?

The studies cited above revealed that different training procedures can affect response times, error scores, and sometimes both, depending on the training technique. Although most studies involving modification of impulsive behavior have used training techniques which were very brief, significant differences have been found in performance on post-tests. What most studies have failed to show, and what logically seems most important, is whether or not training can produce changes in tasks other than match to figure tasks such as the MFFT. The main purpose of this study is to examine conceptual tempo before and after the application of two training techniques and to determine whether generalization occurs to such situations as achievement test performance, and delay of gratification. As delay of gratification implies self-control mechanisms, it would seem plausible that this paradigm might be related to such cognitive controls as reflection-impulsivity. In a previous study,

Hargrove and McKenna (1972) found results which supported this hypothesis. Findings also indicated that reflectivity was positively correlated with achievement test performance. Now, if you alter reflectivity by training, do you alter achievement and delay of gratification?

The two training techniques employed in this research was an analytic training technique and a delay technique. The analytic method emphasized delay in response time in addition to specific training in attending to relative attributes of the stimuli. The delay method emphasized delay in response in addition to imitation of the experimenter's scanning technique. A control group was included which received no training. The following hypotheses were made: (1) Both techniques, analytic and delay, will produce improved performance on the MFFT, resulting in fewer errors and longer latencies, than the non-trained group; (2) Improvement will generalize, resulting in improved performance on the CPI for both trained groups, relative to the non-trained group. Both analytically trained subjects and delay trained subjects will delay longer in the delay of gratification situation as compared with control subjects; (3) Analytic subjects will make fewer errors on the MFFT than delay subjects. Both groups will not differ in terms of MFFT latency; (4) Analytic subjects will perform better on the CPI as compared to delay subjects; (5) Both groups under training will not differ in terms of their behavior in the delay of gratification situation.

METHOD

Subjects. All subjects for this experiment were enrolled in day-care centers in Williamsburg, Virginia. There were 43 subjects, 26 males and 17 females. All subjects were black and of low socioeconomic status in terms of family income. These children ranged in age from 4 years, 2 months to 5 years, 6 months, the average age being 4 years, 6 months at the beginning of the study.

Instruments

Caldwell's Cooperative Preschool Inventory (CPI)

This inventory is a brief assessment and screening procedure designed for individual use with children in the age range three to six years. It was developed to give a measure of achievement in areas regarded as necessary for success in school. A total score and four sub-scores are obtained from the test. The sub-scores are labelled in the manual as (1) "Personal-Social Responsiveness (CPI-I)", (2) "Associative Vocabulary (CPI-II)", (3) "Concept Activation-Numerical (CPI-III)", and (4) "Concept-Activation Sensory (CPI-IV)". There is a correlation of .59 between this inventory and IQ for the age group 4-0 to 4-5, and a correlation of .64 for the age group 4-6 to 5-6.

Matching Familiar Figures (MFFT)

A test developed by Kagan to measure impulsivity-reflectivity (Kagan, 1964). The pre-school subject is shown a standard picture and four test figures, one of which is identical to the standard. He is asked to select the one test picture that looks "just like the standard."

The MFFT items are constructed such that each incorrect figure differs from the standard with respect to only one design feature. The items used include such objects as a boat, a telephone, cowboy, lion, and dress. The major variables scored are response time to first choice and errors.

Delay of Gratification Task (DG)

A paradigm developed by Mischel (1966) to measure length of time which a child will wait for a preferred delayed reward before forfeiting it for the sake of a less preferred immediate one.

Procedure

Before the experiment was undertaken, the experimenter met with two assistants to train them for administration of tests. It was necessary to use assistants in testing and retesting in order to insure that the trainer was blind concerning the childrens' R-I scores. The experimenter observed both assistants during several practice trials to insure that they administered the tests correctly. The experimenter and the assistants were black college females.

Task I. All subjects were individually administered the CPI by the assistants. A total and four sub-scores were obtained. Approximate administration time per subject was 20 minutes.

Task II. All subjects were individually administered the MFFT by the assistants. The variables obtained were latency to first response and errors. Stop watches were used to record response latencies. All testing took place in a special room provided by the daycare centers. Administration time was approximately 20 minutes per child.

Training. All training was done by the author. Subjects were classified as reflective or impulsive according to their score on the

MFFT. Subjects were then rank-ordered on latency to first response and errors and placed in matched triplets. Within a triplet, subjects were randomly assigned to one of three conditions; a delay training condition, an analytic training condition, and a control condition. This matching was done without the trainer's knowledge of the individuals within each condition.

Delay Group. This condition involved training in which a delay period was enforced. During the delay period the child was instructed to pay attention to the stimuli until told to respond. In addition, he was told to model the trainer's looking behavior. If at any time the child failed to be attentive (e.g. looking around the room, playing with fingers, etc.), he was again instructed to look at the material before him. At the end of the delay period, the child was asked to indicate his choice by pointing. There were four training sessions in which the tasks varied along a dimension from simple sensorimotor abilities to more complex problem solving abilities. Before each session, the trainer modeled the approximate response for each child. Each training session was approximately 20 to 30 minutes for each child. A stop watch was used to record the time. After each session the child was given a small reward (e.g. piece of candy, bubble gum, etc.).

Training Session I - Copying Drawings.

The material for this task was taken from the Minnesota Preschool Scale, developed by Goodenough, Maurer & Van Wagenen. In this task the child was asked to look at a figure and study it so that he could reproduce it when told to do so. Specific instructions were: "Look at this figure. I want you to look at it real good so that you can draw

it when I tell you to. Don't start until I tell you to. Remember to look at it real good so that you can do a good job. Watch me first so that you will know what to do." At this point the trainer modeled the approximate response, strongly emphasizing looking behavior. The modeling was as follows: "Alright! I am suppose to make a picture that looks just like this one. I have got to look at it real good. Watch my eyes and see how I am looking at only the picture. (There is silence at which the trainer looked directly at the drawing and appeared to concentrate only on the particular figure). O.K. the time is up. I will draw it now. Do you think you can do that? Let's try it." The subject was then given several items to practice on before undertaking the task. There were 15 items in the task, ranging from simple to more complex. The child was allowed one trial per item and was forced to delay for 10 seconds. Total training time was 20 to 25 minutes.

Training Session II - Completing Pictorial Series.

The items for this task were taken from the Primary Mental Abilities test for grades K-1. The child was shown two pictures, one complete and the other incomplete. He was told to finish the picture and make it look just like the completed one. Specific instructions were: "Look at these pictures. They don't look alike, do they? One of the pictures is not finished. I want you to finish it. Before you do I want you to look at both of them real good and I'll tell you when to start. Remember you are to make this picture look just like this one over here. Watch me first so that you will know what to do. (The trainer modeled the desired response, making sure to tell the child to watch how his, the trainer's, eyes looked at the pictures)." The child was forced to delay for 10 seconds for each of the 18 trials.

Training sessions lasted approximately 20 minutes.

Training Session III - **Similarities.**

The items for this task were taken from Cattell's Culture Fair Intelligence Test, for children 4-8. This task was very similar to the MFFT in that the subject was presented with a standard picture and six alternatives, only one being exactly as the standard. Specific instructions were: "Look at these pictures here. I want you to find the one picture that looks exactly like this one over here. In order to find the right one you must look at all of the pictures real good so that you will pick the right one. Don't tell me your answer until I tell you to. Watch me first so that you will know what to do." (The trainer modeled the desired response as in previous tasks). Each subject was given several items on which to practice. There were 12 items in this task and the child was allowed 12 trials. As this task was felt to be more difficult, the child was allowed or forced to delay for 15 seconds. Actual session lasted from 20-25 minutes.

Training Session IV - Picture Puzzles and Spatial Relations.

This training session was divided into two parts. For the first half, the child was required to put pieces together to make a picture. The materials were taken from the Minnesota Preschool Scale. All pictures were very colorful and familiar (e.g. horse, apple, etc.). The puzzles were presented to the child in the order of simple to more complex (items became more difficult in that more pieces had to be assembled). Specific instructions were: "Look at these pieces. This looks like a puzzle, doesn't it? If these pieces are put together in the right way they will make a picture. I want you to look at each piece real good and see if you can figure out how they go together. Watch

me first." There were 6 items in this task. The child was forced to delay for 15 seconds, resulting in the session lasting about 15 minutes.

In the second part of the session, the child was presented with a picture of an incomplete standard geometric figure and four alternative pictures. The object of the task was to pick from the alternatives the one piece that, when fitted together with the standard, would result in a complete picture. The items for this task were taken from the Primary Mental Abilities Test. The child was given the following instructions: "Look at this picture. It is not a whole picture, is it? Now look at these pieces over here. There is one piece that will fit right into the picture over here and make it whole. I want you to find it. Don't tell me which one it is until I ask you to. Watch me first." (The trainer modeled the appropriate response as before). There were 8 trials and the child delayed 15 seconds per trial. Training time for this half was about 15 minutes.

Analytic Group. This treatment was designed to train children to attend to critical dimensions of objects, particularly emphasizing coginative scanning of information as opposed to visual scanning found in delay training. This training also emphasized breaking materials into parts in order to find the critical attributes. This was done mainly through having the child to verbalize what he was doing. Modeling consisted of demonstrating to the child what he was to say. For each session the modeling was different in that different demands were required. No child was allowed to exceed the 10 or 15 second time limit (enforced delay time for Delay group) in making his analysis. Training time for each session was approximately the same as the delay

group. Each child was reinforced after each session. As the two training conditions differed only in respects to the demands of the tasks, and not materials employed, only the instructions which were given are listed for each task.

Training Session I - Copying Drawings.

"Look at this picture here. I want you to make one that looks just like it. Before you draw it, make sure that you can do it. I want you to watch me so that you will know what to do." The trainer then modeled the response as follows: "Let's see! I've got to make a picture that looks just like this one. This figure looks like a circle. Before I draw it I will trace it with my fingers so that I can be sure to get it right. I will trace it slowly and feel just how it is suppose to be. O.K. I think I can draw it now." The child was given several items on which to practice and was continuously prompted as to what to do before drawing the picture. The child was given the same number of trials as in the delay condition.

Training Session - Completing Pictorial Series.

"Look at these two pictures. I want you to make this picture look just like this one over here. Before you do you must find out what it is that is missing from the picture. Watch me first and see how I do it." Modeling procedures were as follows: "I'm to make this picture look just like this one. This one looks like a box. It has four sides. This other one is not like this one because it has only three sides. I must make them look alike. I think I can do it now." Before the subject attempted to complete a drawing, the trainer questioned him about a particular figure (e.g. "What part is missing in this figure."). The child was allowed 10 seconds to analyze a particular picture.

Training Session III - Similarities.

"I want you to look at these pictures. There is one picture in this group that looks just like the one over here. I want you to find it. In order to find the one that is exactly the same, you must look at all of the pictures real good so that you can be sure to get it right. I want you to watch how I do it so that you will know what to do." The trainer then modeled the desired response which was as follows: "Let's see! I must find the jug like the jug over here. This one is not like it because it is too skinny. This one is not like it because it has handles on it. This one looks like the right one but before I say that it is I must look at the other ones to make sure I don't skip anything." The child was allowed 15 seconds.

Training Session IV - Picture Puzzles and Spatial Relations.

Picture Puzzles. For this task, the subject was allowed to observe in addition to handling the pieces of puzzle. The trainer gave the following instructions: "Look at these pieces. They have been taken apart but they can be put back together. Before you put them together I want you to pick up each piece and say what you think it looks like. Watch me first." The following response was modeled: "Let's see! this piece looks like two legs. This piece here looks like a head and a back. I think this is going to make a horse. I will put these two together." The trainer picked up each piece and examined it before attempting to put them together. The child was always prompted to do the same. As in the delay group each subject was given 15 seconds in which to analyze.

Spatial Relations. For this part of the session, the following instructions were given: "Look at this picture. It is not a square,

is it? It is part of a square. The rest of the square is over here in this group. I want you to look at each piece and find which piece is the part that fits into the picture over here (pointing to the standard). Watch me first." The following modeling was done: "Now, I have got to find the piece that fits right into this picture over here. Is it this one? It is not this one because this is a circle. This piece here is too big to fit into the picture. This piece looks like it will fit but I will look over all of the pieces first to make sure that I am right." During the time the child analyzed each item, the trainer always questioned the child (e.g. "Will this piece fit? Why not?").

Control Group. Subjects in this condition met with the trainer as regularly as the subjects in the training groups. Going for walks and reading stories were some of the activities engaged in in order to avoid activities which involved reflective or impulsive tendencies. The subjects were rewarded after each meeting.

Post Testing. On the last day of the training period for each subject, the trainer introduced the delay of gratification test. The trainer presented the child with two choices. In one case the child could obtain a small reward (a small piece of candy) or wait until the following day for a larger reward (a bar of candy). Specific instructions were: "Let's see what I have here for you. Oh my! I meant to bring over a big candy bar for you but I forgot it. All that I have here is a little bar. I'll tell you what I will do. If you want to wait I will bring the big candy bar for you tomorrow when I come over or if you don't want to wait until tomorrow I will give you the little bar now. If you choose to take the little bar today, you will not get

a big bar tomorrow. Now, would you rather take the little piece today or wait for me to bring you a big piece tomorrow? Which one would you rather do?"

The trainer then assessed the child's comprehension by asking questions such as "Can you tell me what you will get if you wait until tomorrow? Which one will you get if you don't wait until tomorrow?" All subjects appeared to understand.

After the delay of gratification testing, each child was again administered the CPI and the MFFT by the assistants. The experiment was designed in such a way that all post-testing occurred approximately two to three days following training.

RESULTS

The results are presented in the following order: (a) intercorrelation of dependent variables on pretest, (b) means for pre- and post tests, (c) analysis of variance of pretest-posttest differences, and (d) results of delay of gratification tests.

Intercorrelations

Table 1 presents the intercorrelations among the three major variables for the entire group of subjects. The three variables were errors and response time on the MFFT, and CPI scores (a total score and 4 sub-scores). The general pattern of the data was concordant with findings from earlier investigations. There was a negative relation between errors and response time ($r=-.41$, $p < .05$). Previous investigations have revealed nonsignificant positive relations between latency and achievement. In the present data, all intercorrelations were negative and nonsignificant. However, there was consistency with previous findings in that errors were negatively related to achievement. Correlations for the group were negative and nonsignificant, with only one of five measures reaching significance (CPI-III, $r=-.32$, $p < .05$).

Means

Table 2 presents the means and the standard deviations for all variables on pretests for both sexes. There were no major differences in average response time, error, and CPI scores between males and females. The CPI mean total score of 52.40 indicates that their performance falls at the seventy-fifth percentile of a national normative

TABLE 1

INTERCORRELATION OF MFFT SCORES AND CPI SCORES

Variable	1	2	3	4	5	6	7
1. MFFT Time		-.41 *	-.05	-.05	-.07	-.05	-.15
2. MFFT Error			-.29	-.07	-.27	-.32*	-.27
3. CPI - Total				.72 **	.67**	.88 **	.84 **
4. CPI - I					.41 *	.69 **	.38*
5. CPI - II						.48 *	.38*
6. CPI - III							.68 **
7. CPI - IV							

* $p < .05$
** $p < .01$

TABLE 2

MEAN SCORES ON MFFT AND CPI

Variables	Group	Males	Females
MFFT			
Response Time			
M	1.93	1.96	1.89
SD	.78	.75	.85
Errors			
M	3.88	3.65	4.24
SD	1.89	1.77	2.05
CPI - Total			
M	52.40	52.27	52.59
SD	6.83	6.40	7.65
CPI - I			
M	15.67	15.42	10.06
SD	1.61	1.70	1.44
CPI - II			
M	8.77	8.96	8.47
SD	1.91	1.91	1.94
CPI - III			
M	11.49	11.69	11.18
SD	2.44	2.11	2.92
CPI - IV			
M	16.63	16.46	16.11
SD	2.47	2.42	1.86

group of Head Start children. If they are compared with North Carolina children of comparable socioeconomic status, they are at the eighty-fifth percentile.

Analyses of Variance

In order to assess the effects of training, seven analyses of variance were performed on the difference scores. Difference scores for all variables were derived at by substracting the pre score from the post score, and, in order to convert all negative numbers to positive ones, constants were added. A constant of 5 was added to all CPI scores, 10 to all MFFT error scores, and 1 to all MFFT response time scores. Variance was analyzed for the main effects of (1) pretest reflection-impulsivity (defined by response time), (2) sex, and (3) training conditions and their interactions. The results are summarized for each dependent variable separately.

MFFT Time

There was a main effect of training conditions upon MFFT time. In order to explore the source of this effect, a posteriori comparison test was performed on the means using Tukey's HSD (honestly significant difference) Test. Subjects under the control condition had a mean increase in response time of 1.76 seconds whereas those under the training conditions had mean increases of 5.35 and 4.43, for analytic and delay conditions, respectively. Application of Tukey's test yielded a significant difference ($p < .05$) between the training conditions and the control condition, indicating that the treatment conditions differed significantly from the control condition, but that the difference between the two treatment conditions was negligible. Table 3 summarizes the results of the MFFT time analysis. See Figure 1 for a comparison

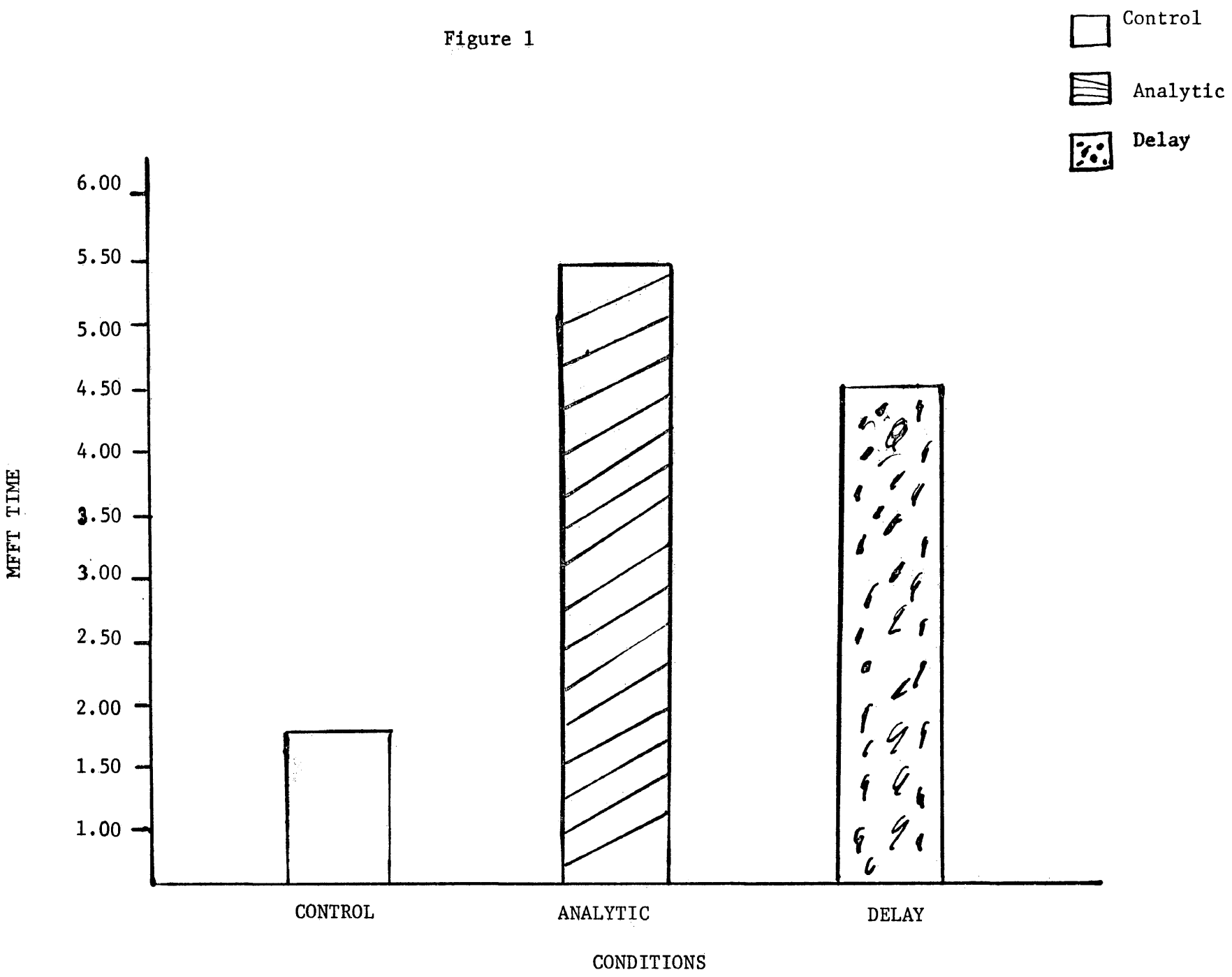
TABLE 3

ANALYSIS OF VARIANCE SUMMARY TABLE
FOR MFFT RESPONSE TIME

Source	df	MS	F
A (Reflection/Impulsivity)	1	2.29	0.47
B (Sex)	1	0.71	0.15
C (Training)	2	40.37	8.31***
AB	1	5.73	1.18
AC	2	17.01	3.50**
BC	2	12.20	2.51*
ABC	2	0.51	0.10
ERROR	32	4.86	-

* $p < .10$
** $p < .05$
*** $p < .005$

Figure 1


Control
Analytic
Delay
6.00
5.50
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
MFFT TIME
CONTROL
ANALYTIC
DELAY
CONDITIONS

of the three groups.

There was a significant interaction of impulsivity-reflectivity and training conditions, as shown in Table 3, suggesting that MFFT time was influenced by both a child's initial status on the reflective/impulsive dimension and training conditions. Figure 2 illustrates this interaction, showing that impulsive subjects in the analytic group showed a large increase in response time (mean=6.88 seconds) as did the reflective subjects in the delay group (mean=5.18 seconds). Tukey's test revealed that impulsive subjects under the analytic group differed significantly ($p < .05$) from all other groups, excluding reflective subjects under the delay condition. Reflectives under the delay condition differed significantly ($p < .05$) from all groups with the exception of impulsive subjects under the delay group. Table 4 contains the means for all groups.

Finally, the interaction between sex and conditions approached significance, as shown in Table 3. Figure 3 presents this interaction graphically, revealing that males in the analytic condition showed a larger increase in response time relative to all other groups. Females in the delay condition also revealed a differential increase in time. Males in the analytic group increased a mean of 6.39 seconds and females a mean of 5.22. Application of Tukey's HSD revealed that these two groups differed significantly from both males and females in the control conditions ($p < .05$). Table 5 contains the means for all groups. Neither initial status of reflection/impulsivity, nor sex alone yielded significant effects for response time.

MFFT Error

The effects of training upon errors was highly significant (F=6.75,

Figure 2

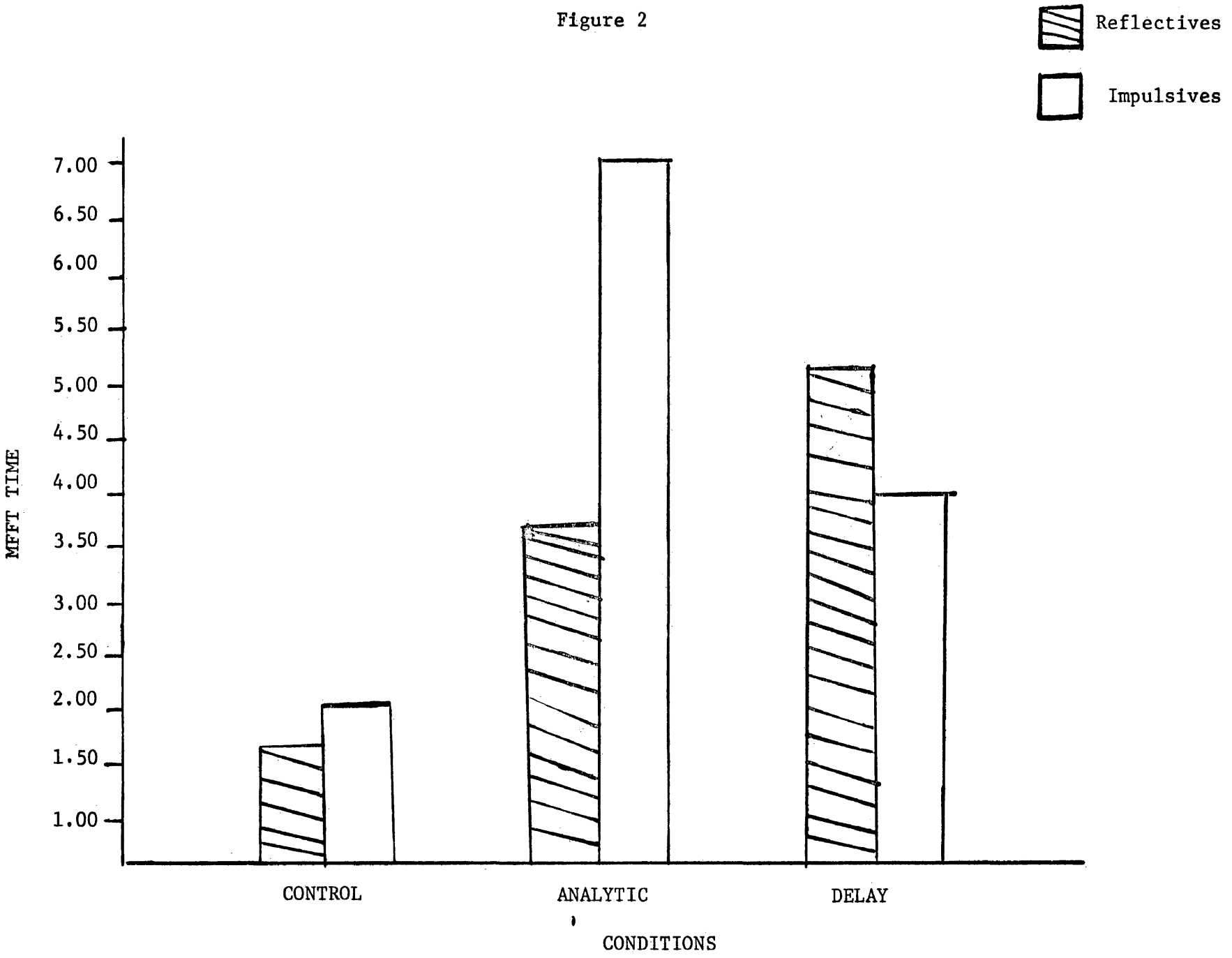

Reflectives
Impulsives
7.00
6.50
6.00
5.50
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
MFFT TIME
CONTROL
ANALYTIC
DELAY
CONDITIONS

TABLE 4

MEAN INCREASE IN MFFT TIME

	Conditions		
	Control (n=14)	Analytic (n=15)	Delay (n=14)
Impulsives	1.88	6.88	3.86
Reflectives	1.64	3.60	5.18

Figure 3

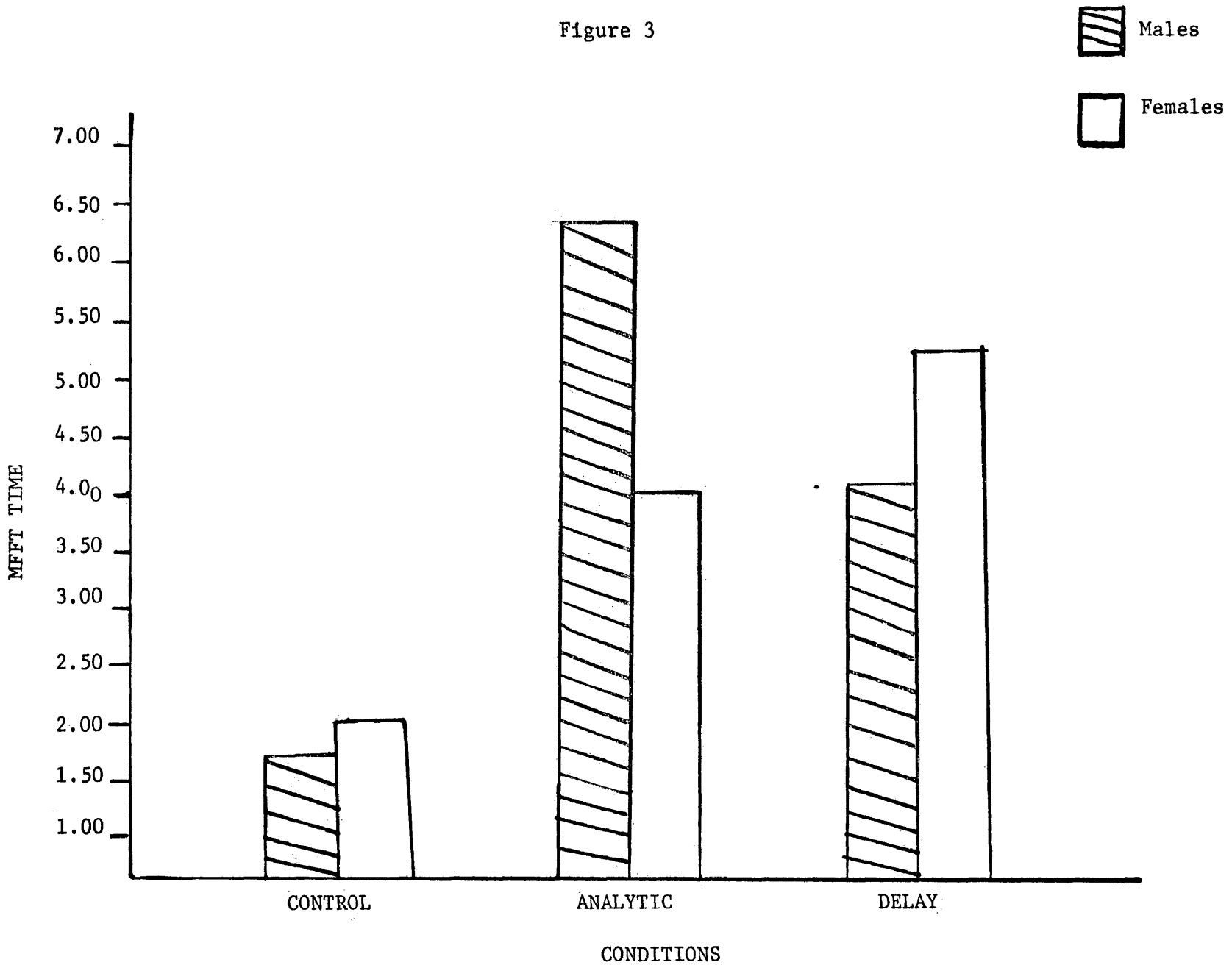

Males
Females
7.00
6.50
6.00
5.50
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
MFFT TIME
CONTROL
ANALYTIC
DELAY
CONDITIONS

TABLE 5

MEAN INCREASE IN MFFT TIME

	Conditions		
	Control	Analytic	Delay
Males	1.69	6.39	3.99
Females	1.86	3.79	5.22

df=2, $p < .005$). Subjects under the control condition had a mean decrease of 10.85 points, whereas the analytic and the delay subjects decreased a mean of 8.46 and 8.21, respectively. Tukey's HSD test revealed a significant difference between the trained and the control conditions ($p < .05$), the control subjects making more errors than those subjected to treatment. The two treatment conditions did not differ significantly from one another. There were no other significant main or interaction effects for errors.

CPI Scores

There was a single significant main effect for CPI - total score due to reflection/impulsivity, as shown in Table 6, thus suggesting that pre to post changes on the CPI total were affected by a subject's reflective or impulsive score on the pretest. Reflective subjects had a mean increase of 12.75 points and the impulsives an increase of 10.29.

The interaction between reflection/impulsivity and training conditions approached significance. Figure 4 presents a graph of this interaction, indicating that reflective subjects performed better under all three conditions as compared to the impulsive subjects. The figure also reveals that impulsive subjects under the delay decreased their scores relative to all other groups. Tukey's statistic showed that only reflectives in the delay group and impulsives in the delay group differed significantly from one another ($p < .05$). Table 7 contains the means for all groups.

There was an interaction between improvement on CPI-III and sex approaching significance ($F=3.48$, df=1, $p < .10$). Males improved 7.35 points and females 6.15, not significantly different according to Tukey's test. There was also an almost significant interaction between impul-

TABLE 6

ANALYSIS OF VARIANCE SUMMARY TABLE
FOR CPI-TOTAL SCORE

Source	df	MS	F
A (Reflection/Impulsivity)	1	76.47	4.24**
B (Sex)	1	16.87	0.94
C (Training)	2	2.74	0.15
AB	1	0.17	0.01
AC	2	47.75	2.65*
BC	2	6.49	0.36
ABC	2	22.03	1.22
ERROR	32	18.04	-

* $p < .10$
** $p < .05$

Figure 4

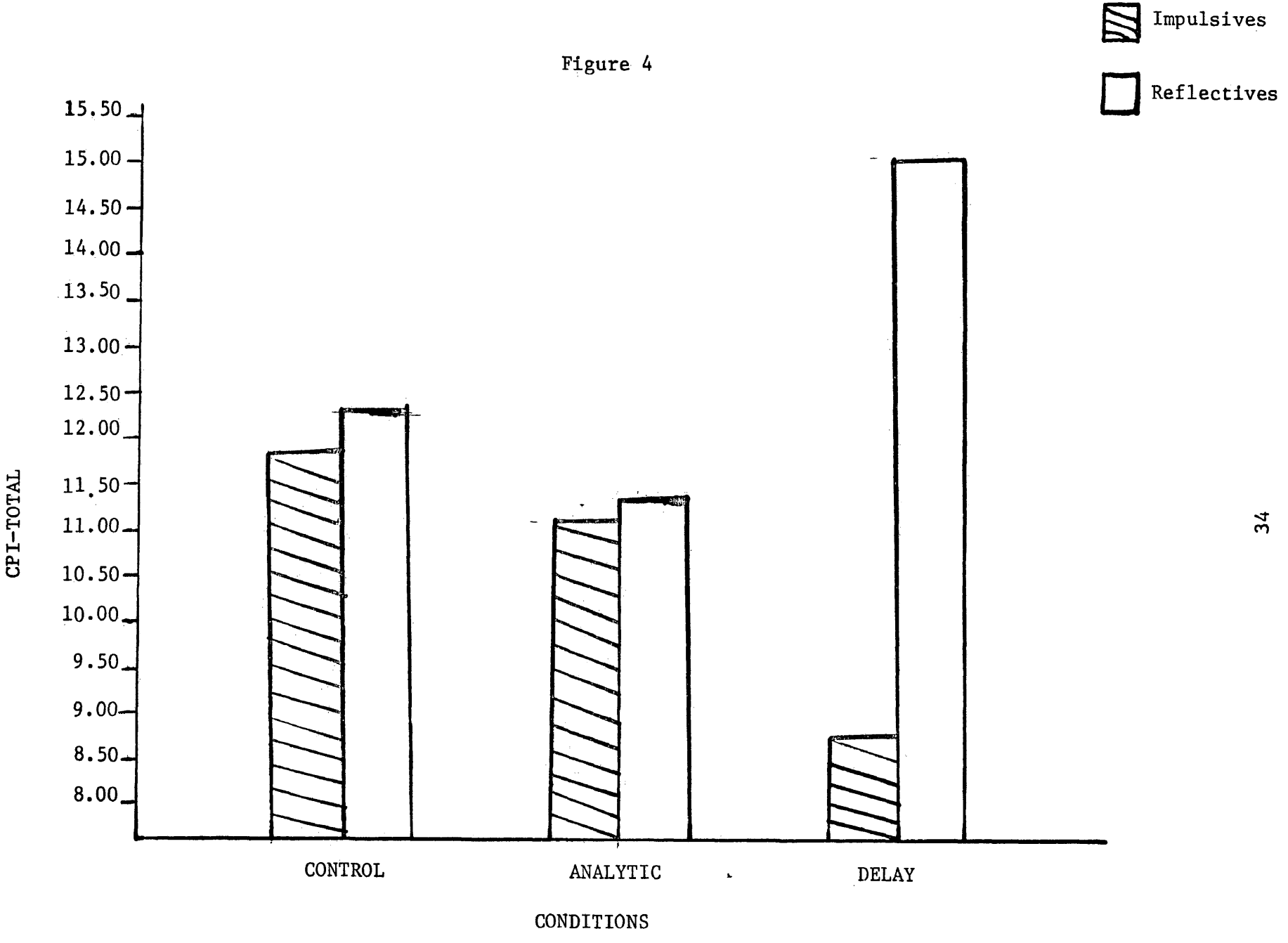

Impulsives
Reflectives
15.50
15.00
14.50
14.00
13.50
13.00
12.50
12.00
11.50
11.00
10.50
10.00
9.50
9.00
8.50
8.00
CPI-TOTAL
CONTROL
ANALYTIC
DELAY
CONDITIONS

TABLE 7

MEAN INCREASE IN CPI - TOTAL

	Conditions		
	Control	Analytic	Delay
Reflectives	12.28	11.28	15.00
Impulsives	11.71	11.00	8.62

sivity/reflectivity and training conditions ($F=2.77$, $df=2$, $p < .10$). Figure 5 reveals a graph of this interaction, showing that, again, reflective subjects under the delay condition performed better relative to all other groups, whereas impulsive subjects under the delay condition performed worse relative to all other groups. Tukey's HSD revealed that only reflective subjects in the delay group and impulsive subjects in the delay group differed significantly from one another. Table 8 contains the means for this interaction. There were neither significant main effects nor interactions for variables CPI-I, II, and IV.

Delay of Gratification

Analysis of this data revealed that of the 25 subjects who delayed, 11 underwent analytic training, 9 underwent delay training, and 5 control. Of the remaining 18 who did not delay, 4 were analytic, 5 delay, and 9 control. A x^2 performed on the data using a 2 3 design (delay/no delay times conditions), approached significance ($x^2 = 4.52$, $df=2$, $p < .10$). When the two treatment conditions were combined and compared to the control group, a significant statistic was obtained ($x^2 = 4.28$, $df=1$, $p < .05$), indicating that trained groups delayed more often than the nontrained group.

Figure 5

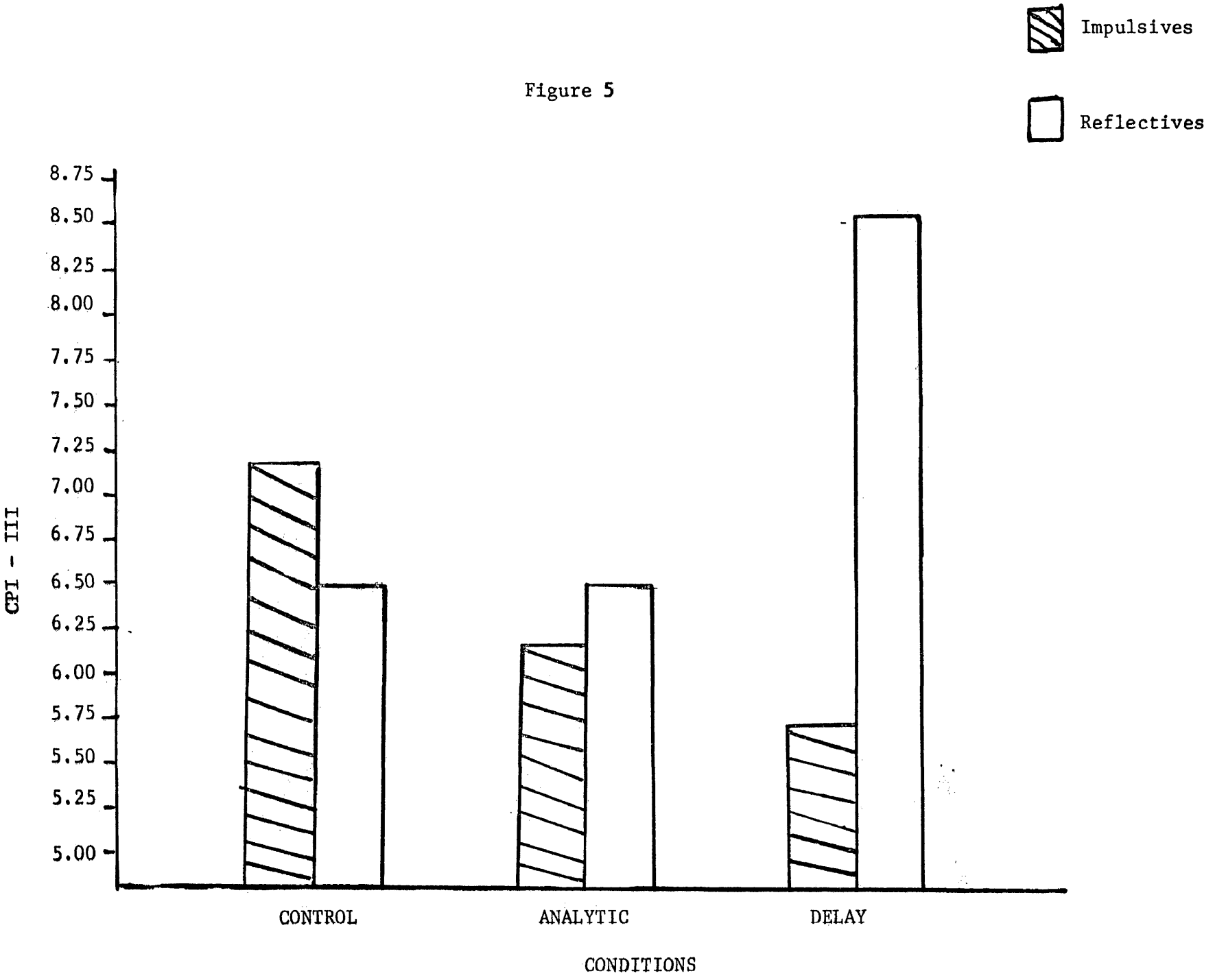

Impulsives
Reflectives
8.75
8.50
8.25
8.00
7.75
7.50
7.25
7.00
6.75
6.50
6.25
6.00
5.75
5.50
5.25
5.00
CPI - III
CONTROL
ANALYTIC
DELAY
CONDITIONS

TABLE 8

MEAN INCREASE IN CPI - III

	Conditions		
	Control	Analytic	Delay
Reflectives	6.42	6.42	8.50
Impulsives	7.14	6.12	5.62

DISCUSSION

This research was designed to test the effects of two methods of training on the reflection-impulsivity dimension. It was predicted that both training conditions would produce changes in latency and errors on the MFFT, the greatest effect being observed in the more impulsive children. It was further predicted that analytic and delay trained subjects would show greater reflectivity on the MFFT in comparison to a control group. A third prediction was that analytic and delay subjects would show greater increases in performance on achievement as compared to control subjects, and finally, that analytic and delay trained subjects would show more delay of gratification than their control peers.

The hypothesis that children trained to be analytic and trained to delay would reveal longer response latencies was clearly supported. Furthermore, the hypothesis that children trained to be reflective would make fewer errors was also confirmed. These data corroborate the results of earlier investigations which revealed that training children to delay produced a significant change in response times (Kagan, 1966; Meichenbaum, 1970). The present research differed from previous findings, however, in that training not only produced changes in response, but error scores as well. Results were in the anticipated direction, for both training groups made fewer errors and had longer response latencies than the nontrained controls. The expectation that training in reflectivity would produce the greatest effect on impulsive subjects was upheld for response time, but only for those subjects in

the analytic group. However, the reflective subjects under the delay condition also improved significantly, perhaps suggesting that the analytic condition was better for a particular disposition, namely impulsive, whereas reflective subjects may have worked better under the delay condition. The two groups, impulsives and reflectives, did not differ in terms of decrease in error rate. The question of why only impulsives in the analytic condition improved significantly in their response latencies as compared with impulsives in the delay condition warrents further discussion. Yando and Kagan (1968) have pointed out that training in specific-problem solving strategies rather than training in response delay is required to improve the performance of impulsive subjects for both response time and error. This speculation held true for only response time.

The hypothesis that trained subjects would show larger increases in achievement as compared with control subjects, was not upheld. The only two groups which were significantly different from one another in their response to the total CPI were the reflective subjects in the delay group and the impulsive subjects in the delay training group. Whereas reflective subjects under the delay group performed better relative to all other groups, it is interesting that impulsive subjects under the delay group performed worse as compared to other groups. The reason for this may be that forcing impulsive subjects to delay without instructing him in the use of cognitive strategies may create a perplexing situation in that he learns how to delay but he does not learn what to do while delaying. Subjects also revealed the same pattern in their response to part three of the CPI. The failure of reflective training to generalize to this achievement test may be due to several reasons: (1) the limited

number of training sessions; (2) the lack of sensitivity of the assessment measure; (3) the fact that the subject was presented with the same test in the pre and post testing, thus allowing a high degree of familarity and (4) the emphasis placed upon response styles rather than attempting to influence intelligence. The prediction that reflectivity would generalize to this achievement situation was based upon previously obtained correlations which revealed a significant correlation between CPI and MFFT (Hargrove & McKenna, 1972). As the study was not replicated, there was no way of knowing that the results were misleading.

The prediction that trained subjects would show more delay of gratification than nontrained subjects was supported. This implies that subjects who were taught to reflect before making a choice also revealed this behavior in a situation which was highly demanding of young children. Those children who were not trained did not display a reflective attitude in the delay situation. As studies have shown that children have difficulty delaying gratification, particularly children of low socioeconomic backgrounds (Schwebel, 1966; Hess & Shipman, 1968), the data looks even more promising. These findings argue for a strong generalizability of training to situations which demand some delay in response, but apparently not to CPI achievement tests.

The results of this study indicate that both training techniques, analytic and delay, were effective in modifying behavior on a psychometric test which assesses cognitive impulsivity, and in a delay of gratification situation. The results suggest that perhaps different cognitive styles require different training procedures, as is shown by impulsives performing better under the analytic condition and reflectives under the delay condition. It is also suggested that the

two conditions produced differential responses to MFFT response time between males and females, resulting in males performing better under the analytic condition and females under the delay condition. At this point these are merely speculations and only further research will establish their validity.

The present analytic procedure seems applicable not only to children, but adults as well, in teaching one to guide his performance by means of critically attending to the demands of a task in a problem solving situation. The implications of the analytic technique seems evident. The possibility of using such a procedure to train children to engage in cognitive behavior, in other words to train children to think, implies that a variety of cognitive styles are subject to change.

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