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EFFECTS OF TRAINING IMPULSIVE STUDENTS TO BECOME REFLECTIVE WHILE PERFORMING ONE-TO-ONE CORRESPONDENCE TASKS

by

Joyce L. Davis

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Approved by

Nancy H. White
Dissertation Adviser

APPROVAL PAGE

This dissertation has been approved by the following committee of the Faculty of the Graduate School at The University of North Carolina at Greensboro.

Dissertation Adviser Nancy White

Committee Members Rebecca M. Smith

J. Allen Watson

J. C. Glenn

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Date of Acceptance by Committee

October 4, 1978
Date of Final Oral Examination

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The purpose of this experiment was to determine the effectiveness of reflectivity training for kindergarten and second grade subjects using one-to-one correspondence tasks. It was hypothesized that there were no significant differences among the Matching Familiar Figures posttest means of response times for the self-verbalization, delayed response, and reflective groups. It was also hypothesized that there were no significant differences among the Matching Familiar Figures posttest means of numbers of errors for the self-verbalization, delayed response, and reflective groups; that there were no significant differences between the posttest means of the kindergarten and the second grade groups regarding response time on the Matching Familiar Figures Test; that there were no significant differences between the posttest means of the kindergarten and the second grade groups regarding the number of errors on the Matching Familiar Figures Test; that there were no significant differences among the posttest means of response times on the one-to-one correspondence test for the delayed response, self-verbalization, and reflective groups; that there were no significant differences among the posttest means of numbers of errors on the one-to-one correspondence test for the delayed response, self-verbalization, and reflective groups. It was further hypothesized that there were no significant differences between the posttest means of the second grade and kindergarten groups regarding the response time measure of the one-to-one correspondence test.

The subjects were selected from all of the kindergarten and second grade students attending Allenbrook Elementary School in Charlotte, North Carolina during the 1977-78 school year. The age range of subjects was from 5 years 2 months to 7 years 6 months.

The Henmon-Nelson Test of Mental Ability was given to all kindergarten and second grade subjects to determine if they possessed the knowledge necessary to understand the language used in the tasks situations and also to determine if they would benefit from participating in the study. All subjects who made satisfactory scores on the Henmon-Nelson Test of Mental Ability were given the Matching Familiar Figures pretest to determine if they possessed an impulsive or a reflective conceptual tempo. This was necessary in order to place subjects in reflective and impulsive groups.

By using the random selection method, two groups consisting of twelve impulsive subjects and one group consisting of twelve reflective subjects were formed. The first group of impulsive subjects was trained by the method of self-verbalization while completing one-to-one correspondence tasks. The second group of impulsive subjects was trained by the method of delayed responses while completing the same tasks. These impulsive groups were compared to a group of reflective subjects who received no training. The same three types of groups were formed on kindergarten and second grade levels. After completion of the four training sessions, all groups of subjects were given the Matching Familiar Figures Posttest and the one-to-one correspondence posttest.

The data were analyzed statistically by using a 2 x 3 x 2 analysis of variance design with post hoc comparisons using the Scheffé statistic. Results showed that trained groups had longer mean response times and fewer mean errors on the posttest of both the Matching Familiar Figures and the one-to-one correspondence tests.

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CHAPTER I

INTRODUCTION

The conceptual tempo dimension reflection-impulsivity has been investigated by many researchers (Block, Block, & Harrington, 1974; Kagan, Rosman, Day, Albert, & Phillips, 1964) who were interested in enhancing the understanding of cognitive styles. The reflective child consistently allows himself sufficient time to consider alternatives to problems characterized by high response uncertainties. In contrast, the impulsive child is reported regularly to offer quick inaccurate responses to the same kinds of problems (Kagan et al., 1964). Other data have referred to the impulsive child as one who is more likely than his reflective classmates to make repeated errors on word recognition lists (Kagan, 1965c), and arithmetic problems (Cathcart & Liedtke, 1969), to exercise poor and inadequate control of motor behavior (Harrison & Nadelman, 1972), and to become inattentive during task performances (Ault, Crawford, & Jeffrey, 1972).

Educators have been concerned about and displeased with the quick inaccurate responses made by impulsive young children and have frequently searched for solutions for such problems. On the other hand, praise has often been given to reflective young children and they have been greatly admired by their teachers and their peers for their speed and accuracy of responses. In many situations, during the early phases of abstract reasoning, when school children deal with mathematical concepts, new experiences encountered give rise to response

uncertainties. In these instances, some correlational studies have shown that impulsive students are hyperactive, emotionally uncontrolled, and take many risks (Block, Block, & Harrington, 1974; Campbell, 1973; Kagan, 1965b; and Palkes, Stewart & Kahana, 1973).

How can this impulsive attitude be modified? One method might be to train impulsive students in strategies for improving accuracy. Such training would greatly enhance success for them in their written and oral classroom performances. Correct responses would aid the impulsive student in acquiring skills that would help to control his possible hyperactive and risky nature, thus enabling him to function more effectively in a classroom group.

The reflective conceptual tempo is advantageous to children in that the child who is considered to be reflective presumably considers and evaluates possible response alternatives; however, the impulsive child offers an answer quickly. It is obvious that the impulsive child does not consider the probable accuracy of his answer (Kagan, 1965a). From studies (Kagan, 1965a; Kopfstein, 1973; and McKinney, 1973) testing and evaluating children on this measure, all indications seem to show that the pattern, to be reflective or to be impulsive is in the process of becoming well established by the time the child begins school or shortly thereafter. It is felt by the investigator that if this pattern is becoming well established at the time of school entrance, it is at the same time or shortly thereafter that the necessary training measures should begin.

This study deals with reflection-impulsivity as defined by Kagan (1965c) and measured by the Matching Familiar Figures Test. However, other factors

may be correlated with impulsive responding and these behaviors may contribute to rapid inaccurate responses.

Sex differences associated with the Matching Familiar Figures Test (Egeland & Weinberg, 1976) show that at the kindergarten level, boys tend to have shorter latencies and make more errors than girls. During test administering sessions at the Fels Institute observations of subjects revealed that impulsive boys as compared to reflective boys were typically more restless and displayed greater distractibility (Kagan, 1965a). It has also been reported (Kagan, 1965a) that children generally are more reflective at older ages.

Hyperactivity seemed to contribute to impulsive scoring on the M F F T. Campbell (1973) reported that hyperactive children have generally been described as restless, distractible, inattentive, and having poor control of impulses. These kinds of children were also reported to have scored very impulsively on the M F F T.

In an effort showing awareness of situations that might contribute to impulsivity, researchers Kagan & Messer (1975) stated that cautions have been made to restrict the context of testing and broad inclusions about reflection-impulsivity to problem-solving situations containing uncertainty of responses.

Statement of the Problem

The problem in this study was to determine the effects of training impulsive kindergarten and second grade students to become more reflective. Tasks of one-to-one correspondence were used in the training sessions as two separate groups of kindergarten and second grade students were trained by one of two

methods. Of the four groups of impulsive subjects selected, one kindergarten and second grade group were trained to delay responses while the other two similar groups were trained by techniques of self-verbalization.

The investigator did thorough investigations before discovering that none of the researchers in the area of reflection-impulsivity attempted to train impulsive kindergarten students and impulsive second grade students by the use of self-verbalizations and delaying of responses techniques while performing one-to-one correspondence tasks. The investigator believes that it would be of value to train impulsive kindergarten and impulsive second grade students to become more reflective by using activities of a Piagetian nature. These are the type of activities in which young children often engage as they interact in their learning environment.

Experimenters (Egeland, 1974; Debus, 1970) attempted to train impulsive second and third grade children through various methods to help them overcome their impulsive behaviors. Debus (1970) conducted research that permitted third grade children of impulsive conceptual tempos to observe sixth grade models who showed differing patterns of reflective and/or impulsive responses as they responded to items on a visual discrimination task. Egeland (1974) helped one group of impulsive second-graders to become more reflective by having them trained in the use of more efficient scanning techniques. He helped another group by emphasizing that they delay their responses. Similarly, Ridberg, Parke, and Hetherington (1971) conducted research that was successful in altering impulsive behavior by having impulsive students view reflective

models. Meichenbaum and Goodman (1971) investigated ways of training impulsive students to use more efficient scanning techniques. This process involved using modeling in conjunction with a self-verbalization procedure. Zeiniker, Jeffrey, Ault, and Parsons (1972) conducted research involving impulsive children in a match-to-sample task that was effective in helping to alter their behavior.

Of the training techniques and methods used, most have produced some significant degree of success for the students involved. Research in the area of reflection-impulsivity has provided valuable knowledge for educators and others who work with young children. However, some methods and techniques of training have been proven to be more effective than others.

Designing mathematical tasks for young children in the primary grades in school has been a common practice for many years. Researchers have been interested in challenging preschool children in tasks involving number and space as well as in other tasks suggested by Piaget. Often included were methods of observing and manipulating impulsive and reflective behavior patterns, while interacting with mathematical materials.

Katz (1971) studied reflective-impulsivity and color form sorting tasks involving children three to seven years old. This researcher's objective was to determine whether the differential development of conceptual tempo could predict preferences in color sorting among young children. Kaplan (1969) investigated class differences in a sorting task involving six-, eight-, ten-, and twelve-year-old boys testing class differences in the effects of impulsivity, goal orientation, and verbal expression. In other investigations of number understandings, Cathcart

and Liedtke (1969) studied reflectiveness-impulsiveness and mathematical achievement involving a sample of second and third grade students. The analysis of collected data suggested that the students who achieved the best in mathematics were those who took longer to consider their responses and were more reflective.

Activities for young children have involved such things as counting and distributing materials on a one-to-one basis. Researchers (Curio, Robbins, & Elsa, 1971; Lavatelli, 1970) have made others aware of the mental processes involved in developing concepts concerning space and number. Through clinical investigations, researchers presented to children between four and eight years of age tasks that would reveal underlaying assumptions about the nature of number. Piaget, one of the leaders in research of this kind, was thought not to have been interested in number readiness as defined by arithmetic readiness tests, but rather in children's awareness of the fundamental properties of number, measurement and space (Piaget, 1952).

In studying prenumber concepts that were designed to help students acquire arithmetic skills, Melnick, Bernstein and Lehrer (1973) investigated the performances of Piagetian tasks and arithmetic skills among educable mentally retarded children. Concepts developed by Piaget in regard to animistic thinking were employed by Berzonsky (1974). This study investigated the role of internality and reflectivity in the normal development of children's concepts of life. Curio, Robbins and Elsa (1971) conducted investigations involving number. One's own body parts were examined in an effort to help children to conserve number. All in all, the reflective-impulsive conceptual tempo seems to have had some effect

on the degree of accuracy with which young children perform mathematical readiness activities.

The investigator believes that if impulsive students can be trained to become more reflective, they will have advantages of becoming much more accurate as they participate with peers in an educational environment. Their self-concept probably will be enhanced by additional praise received from teachers for correct responses.

By including two groups of students in two separate training procedures from different grade levels, the investigator was given the opportunity to make some assessments concerning effectiveness of training impulsive subjects on the kindergarten and second grade levels. Some information concerning the effectiveness of the self-verbalization method of training, as compared to the delayed response method of training, was assessed. The investigator believes as revealed in studies mentioned, that teaching impulsive children more efficient strategies for reflectiveness is important.

Definitions

The following terms, as defined, are used throughout the study.

The Matching Familiar Figures Test. This test is a match-to-match visual discrimination task. It consists of showing the subject a picture of a common object and requiring him to identify correctly the same object from a group of six similar objects. In making a selection, the subject must pay strict attention to small detailed line drawings that might cause the object to be slightly different from the standard. This test measures a child's tendency to have a

reflective or an impulsive cognitive style. A reflective style is characterized by slow accurate responses, while an impulsive style is characterized by fast inaccurate responses. The subject receives a score for response latency (time that he has taken to respond) and another score for the number of errors made on each of the trials. A child who scores below the group median on response time and above the group median on errors is considered impulsive. A child who is above the median on response time and below the median on errors is considered reflective.

Reflectivity. The child is considered to be reflective if, during the lengthier period before his first response, he presumably considers and evaluates possible response alternatives before making a choice that is usually correct. Children who take their time before offering a response and who subsequently produce few errors have been termed reflective (Kagan, 1965a).

Impulsivity. The child is considered to be impulsive if he offers answers quickly without sufficient consideration of the probable accuracy of his answer. The impulsive child offers his answers more quickly and makes more errors than his reflective counterpart on a match-to-sample task called the Matching Familiar Figures Test (Messer, 1970). Children who are quick and inaccurate in their initial responding have been termed impulsive (Brodzinsky, 1976).

One-to-one correspondence. This term means that for every object in one set of objects there is a corresponding object in another set. One-to-one correspondence is a method in which equivalence of sets can be established by some means other than by counting. This method is a mathematically certain way

of establishing cardinal equivalence (Curio et al., 1971). It has been pointed out (Lavatelli, 1970) that logical operations develop from actions of the child in such things as grouping, ordering and comparing. Thought arises out of action (Piaget, 1952), and mathematical thinking exists on the same premises. Therefore, it becomes logical that the child performs by manipulating objects.

Cognitive style. This term is used to describe the manner in which an individual is predisposed to process information in particular tasks.

Conceptual tempo. Tempo is the speed with which one responds to an uncertain, problem-solving situation. In this study, there is a consistent tendency for the child to respond slowly or quickly when confronted with a problem-solving situation that has uncertainty.

Hypotheses

The following hypotheses were tested in this study.

H_1 There are no significant differences among the Matching Familiar Figures Test posttest means of response times for the self-verbalization, delayed response, and reflective groups.

H_2 There are no significant differences among the Matching Familiar Figures posttest means of numbers of errors for the self-verbalization, delayed response, and reflective groups.

H_3 There are no significant differences between the posttest means of the kindergarten and the second grade groups regarding response times on the Matching Familiar Figures Test.

H_4 There are no significant differences between the posttest means of the kindergarten and the second grade groups regarding the number of errors on the Matching Familiar Figures Test.

H_5 There are no significant differences among the posttest means of response times on the one-to-one correspondence test for the delayed response, self-verbalization, and reflective groups.

H_6 There are no significant differences among the posttest means of numbers of errors on the one-to-one correspondence test for the delayed response, self-verbalization, and reflective groups.

H_7 There are no significant differences between the posttest means of the kindergarten and second grade groups regarding the response times measure of the one-to-one correspondence test.

CHAPTER II

REVIEW OF LITERATURE

During the early school years, problems arise in subject matter that require inference from children. Yet, many impulsive young children find it difficult not to yell out an answer, even though they are not sure of its correctness (Kagan, 1966). Many teachers interpret an incorrect answer as the result of poor judgment, faulty knowledge, and even insufficient verbal control. For impulsive children, the possibility of being wrong does not carry the apprehensions that it does for reflective children. Since reflective children tend to exhibit a high ratio of correct responses, an occasional incorrect answer is tolerated from them.

The impulsive conceptual tempo has its beginning very early in the school career of young children, and continues to be overtly present throughout the elementary school years (Kagan et al., 1966). Kagan, Pearson, and Welch (1966) found that reflective or impulsive responding existed for children as young as five years old in problems with high response uncertainty. Their research suggested that impulsive children make many errors in inductive-reasoning tasks that contain response uncertainty. Observations of impulsive children in such cases revealed that often they did not pause sufficiently to evaluate the qualities of their inferences.

In studying mother-child interaction in reflective, impulsive and hyperactive children, Campbell (1973) observed that all three groups of mothers interacted with their child more when the child was performing a difficult task. However, mothers of reflective children intervened at the most crucial times, when they saw that their child really needed help.

The impulsive conceptual tempo seems to be present as young children interact in their total environment. Conceptual tempo has been observed in the areas of mathematical skills as well as in other subject areas in which young children become involved.

Piagetian and Other Mathematical Concepts Related to Reflection-Impulsivity

Concepts developed by Piaget and widely used in research by him have appeared in investigations involving reflection-impulsivity and investigations related to young children's understanding of number concepts. Standardized versions of Piagetian cardinal-ordinal tasks and a triad preference task in which subjects were required to determine which 2 of 3 rows of poker chips were the "same" were administered to kindergarten nonconservers, and kindergarten conservers. The same measures were administered to third grade conservers, and third grade nonconservers (Henry, 1976). The main objective of the study was to compare cardinal-ordinal abilities and attentional preferences of the two groups. The author reported from this study that kindergarten conservers performed significantly better on cardinal-ordinal tasks than did nonconservers. Both kindergarten and third grade students preferred the dimension of number

significantly more often on preference tasks.

It has often been felt that prenumber concepts must precede arithmetic skills. Piagetian tasks are often used to help children acquire concrete number concepts. Melnick, Bernstein and Lehner (1973) were interested in the performances of Piagetian tasks and arithmetic skills among educable retarded children. The basic descriptive data in this performance and the aim of the study was to examine basic data regarding the relationship between performances on some Piagetian tasks and arithmetic skills among young educable mentally retarded children. Two tests were administered which included the Arithmetic Concept Individual Test measuring concepts of seriations, classification, one-to-one correspondence, the correspondence of number, and rotation of landscape. The second was the Arithmetic Concept Screening Test consisting of 77 items and designed to measure concrete concepts underlying quantitative thinking such as form and size discrimination. Twelve white and twenty-four black students were included in the study. These subjects had a mean chronological age of 10.4, a mental age of 6.8, and a mean I Q of 66.26. During the tasks performance, two factors became known which caused the correlation to be insignificant. For the students in the study, the Piagetian tasks were either too easy or too difficult. One-to-one correspondence seemed to have been the easiest task, while conservation of number was the most difficult. Evidence of rote procedures showed that subjects scored lower on prenumber skills than they did on addition and subtraction. The author concluded that there was a significant relationship between arithmetic skills and tasks in Piaget's theory in relation to the development of

cardinal number.

Stages of cognitive development are also thought to have an effect on performances of young children as they deal with tasks in which number skills are involved. A study (Pufall, Shaw & Sydral-Lasky, 1973) was designed to test four predictions dealing with stages from Piaget's cognitive theory. The first explained that a child acquires the ability to judge composition 1, 2, and 3 before being able to judge composition 4. The second explained that the ability to judge composition correctly and the strategy to construct a set in one-to-one correspondence with a model to match the number are two processes that seem to develop simultaneously. The third stated that the reliability of judgments are curvilinearly related to ages while the fourth stated that when a child observes a conserving transformation, it should not influence his judgmental performance at the preoperational stage.

The subjects in the study were 54 white children who were divided into three age groups consisting of Group I: 2.11 to 3.5; Group II: 3.8 to 4.3; and Group III: 4.5 to 5.0 years of age. The subjects were tested on number judgment tasks based on the concepts of Piaget. Each of the five tasks began with arranging four candy pieces in one-to-one correspondence. A number or a spatial transformation or both were constructed in each task. From test results, it was reported that only two of the children achieved number conservation. The tendency to become consistent in their judgment of number with increasing age was found true in only one case. It appeared that more children followed a length hypothesis rather than a density hypothesis. The authors concluded that the longer rows

were thought to have had more candies on tasks 1, 2, 3, and 5, while on task 4 they were thought to be equal. Judgments were based on length by more children in the older groups than in the younger groups. Building a row in one-to-one correspondence with another was thought to be obtained prior to both intuitive and operational qualifications; however, observing a conserving transformation did not seem to have influenced the judgment of the preoperational child. This finding is in opposition to the equilibration model by Piaget.

These findings were consistent with findings by D'Mello and Willemsen (1969) in an investigation that involved the use of four tasks which were believed to demonstrate increasing levels of abstraction in the use of number terms. Subjects involved in the study were 38 young children ranging in ages from 3 to 8 years. A scalogram was used to test the ordering hypothesis. It was concluded that the following order of difficulty existed: reciting number words in sequence, matching spoken words to absolute quantity, and lastly, matching numerals with absolute quantity.

In another study involving young children and number (Curio, Robbins, & Elsa, 1971), one's own body parts were examined in helping children to conserve number. The subjects in the study were 167 nursery school children. In all the tasks procedures, red and yellow pipe cleaners were the materials used. Of the five tasks, the first three were used as an assessment measure to insure that subjects included would benefit from training. The tasks were addition/subtraction, counting, one-to-one correspondence objects, and number conservation with both objects and fingers. For satisfactory performance of the

tasks, it was necessary for subjects to perform correctly on both trials of each of the counting and correspondence tasks; however, in the remaining three tasks, only two of three trials were required for mastery. Twice as many subjects passed the addition/subtraction, counting, and correspondence tasks as they did the correspondence-with-objects or correspondence-with-fingers tasks.

Number conservation with fingers seemed to have provided very much understanding for subjects; therefore, the authors designed a second study to test the effectiveness of training in number conservation with fingers. In order to compare groups, two additional groups were trained with counting and addition/subtraction procedures. From results of the study, Curio, Robbins and Elsa (1971) reported that the parts trained group clearly showed more superior performance than did the addition/subtraction and the rote-counting trained group. Evidence of greatest strength in effects of training was shown in the comparison of subjects who had mastered number conservation with fingers and were trained in the addition/subtraction groups or rote-counting groups. This was thought to be true because prior possession of finger conservation was not evident.

In an investigation of the young child's understanding of number and conceptual tempo, Cathcarte and Liedtke (1969) tested reflectiveness-impulsiveness and mathematics achievement involving a sample of forty-six second-grade students, and a sample of twelve third-grade students. It was concluded that students who were considered to be the highest achievers in mathematics were more reflective and took longer to consider their responses; however, the authors cautioned that sometimes standardized mathematics tests are timed.

This often puts the reflective child at a disadvantage because his cognitive style places no importance on speed.

Katz (1971) sought to determine whether predictions in color form sorting could be determined by the differences in the development of children's conceptual tempo. Of the 67 forty-four to sixty-five month old children involved in the study, it was concluded that reflective children took longer to give responses and made more comparison glances than did impulsive children. Young children also responded more to color in sorting than they did to form.

In a similar study involving sorting 6-, 8-, 10-, and 12-year-old children of middle and lower social classes were studied under three conditions (Kaplan, 1969). The conditions were (a) the effects of impulsivity versus forced delay of responses, (b) the effects of problem-oriented context versus the context of less structured demands, and (c) the effects of verbal versus nonverbal requirements for response transmission. Results showed that lower-class children functioned more poorly on the tasks than did middle-class children. Lower-class children were also found to have been much more impulsive than were middle-class children. Hence, lower-class children showed much lower scores than did middle-class children at age 6, but at age 8 the scores of the lower-class group was close to those of their middle-class peers.

Reflection-impulsivity has been the focus of investigations in other subject matter areas similar to those discussed involving number concepts. The investigator believes that number skills is an important area in which children need help in controlling their impulsive conceptual tempo.

Reflection-Impulsivity and Aspects of Reading Performances in Young Children

In the early school grades, and often later, reading is thought to be one of the areas on which teachers place great emphasis. One study that has related reflection-impulsivity and reading skills in school children in primary grades (Kagan, 1965c) involved 130 subjects who were administered visual matching problems. These problems included designs and pictures and reading recognition tests given at the end of the first and second grades. Scores indicated that the impulsive subjects made more errors in reading English words than did the reflective subjects.

In a study of 100 good and poor readers in grades four to eight, a repeated measure analysis of variance was employed. The study was designed to test the relationship of reactive inhibition to skill attainment in reading (Otto & Fredricks, 1963). An inverted number printing task served as a measure to determine inhibitions. Results of the study showed that good readers did not generate as much reactive inhibition as did poor readers.

In another study involving reading and preschool children, the author's purpose was to ascertain the strength of the correlation between auditory-visual integration and kindergarten students' performance on reading readiness skills and to determine whether their test performances were influenced by an impulsive or a reflective conceptual tempo. With the knowledge that audio and visual skills are closely related to reading skills, Margolis (1976) stated that it was not known if these factors were significant in tests of reading performance and he sought to investigate for correlations.

The subjects in the study made satisfactory scores on the Snellen Chart as a prerequisite for being included in the study. The Snellen Chart was used to screen defective vision that students might possess. Three different test situations were used to complete the testing. The tests given included the Matching Familiar Figures Test, (MFFT) a modified version of Birch and Belmont's auditory-visual integration test, and the Information, Comprehension, Similarities and Vocabulary subtests from the verbal portion of the Wechsler Preschool and Primary Scale of Intelligence. Four groups were formed which had eleven subjects each. Included were separate groups of impulsive and reflective female and male subjects. The Metropolitan Readiness Test was administered to these groups. Regardless of response time, reflective subjects performed significantly better than impulsive subjects on the test of auditory-visual integration and the test of reading readiness; however, when scores were equated for the W P P S I verbal I Q, these differences were not significant.

In a study of reflectivity and reading errors (Kagan, 1966), it was revealed that word recognition errors were related to recognition errors on the M F F T and the Haptic Visual Matching Test for both boys and girls. Among both boys and girls, the longer the delay before offering a solution hypothesis on the M F F T, the more the subjects were able to recognize initial words spoken by the examiner.

Reflection-Impulsivity and Personality Traits

Whether a conceptual style is reflective or impulsive has been attributed to the degree that students take pride in their very own performances on

selected measures. In daily tasks and in exercises in school as well as out of school, some children approach life's situations carelessly and haphazardly, while others exercise extreme caution and take great pride in everything that they do. Cognitive tempo has been related to personality traits that children possess. Moreover, a very important aspect of personality is thought to be a person's own style of making a decision. Some individuals make decisions almost immediately regardless of the circumstances or incidents involved, while others exercise lengthy pondering before making a final decision.

In focusing on personalities of children as a correlation of reflection-impulsivity (Kagan, 1965a), seventy-five children at the Fels Institute were studied by observational techniques. Many of these observations were made in the children's homes. It was concluded that reflective children while playing or interacting with others avoided dangerous and risky situations and those situations that were most likely to produce failure or humiliation.

Block and Peterson (1955) also concluded from a duplication of research by Festinger (1943) that personality variables were relevant for an understanding of decision confidence and decision time. The research by Block and Peterson (1955) used 53 military officers as subjects. It also showed that subjects who made decisions hastily were passive and conforming, while those who exercised caution and thought carefully, showed evidence of being self-assured, ascendant, and humorous.

Reflection-Impulsivity and Problem-Solving Behavior

The term "stringent response criteria" has been associated with individuals who do not select a response until there is a great bit of evidence supporting their choice. On the other hand, individuals who select responses readily and with less supportive evidence are thought to possess a "loose response criteria" (Klein, Blockovich, Buchalter & Huyghe, 1976). Inasmuch as reflection-impulsivity is related to response latency and error rate, there is thought to be a correlation between impulsivity and loose criteria and reflection and stringent criteria for response selection. When a stringent criterion is involved, reflective subjects should then perform better than impulsive subjects. The authors stated that when tasks are compatible with loose criteria, impulsive subjects should outperform reflective subjects.

In an investigation (Klein et al., 1976), 88 children with a mean age of 9 years were classified as reflective or impulsive from results obtained on the M F F T. Convergent thinking was evaluated with a word-sequence task in which subjects were asked to arrange words so that they made a pair. Divergent thinking was assessed by using the Unusual Uses Task. Children were requested to record as many ways as possible for using pencils and newspapers. Three categories were used to classify the scores of the Unusual Uses Task: (1) fluency, relating to the total number of responses to each object; (2) originality, relating to uncommonness of responses; (3) flexibility, relating to the number of categories in response to each object.

The findings of this study showed a strong correlation between reflection-impulsivity and convergent problem-solving ability. The authors reported that greater success in an inductive reasoning task is related to reflective style. The authors also suggested that the M F F T was a convergent problem-solving task. However, the study showed no relationship between reflection-impulsivity and the ability to use divergent thinking in problem solving. These results were expected. Nonetheless, reflective children made significantly fewer errors on the convergent problem-solving task than did their impulsive counterparts.

As implied in the above study, problem solving is an area in which significant differences are thought to appear for reflective and impulsive students. Klein, Blockovich, Buchalter, and Huyghe (1976) investigated the performances of both types of subjects on divergent problem-solving tasks. The subjects in the study were 88 children with a mean age of 9 years and 2 months; 39 of the subjects were male and 49 female. The subjects were given a word sequence task which was scored as correct or incorrect; no allowances were made for latency. The second task required subjects to give the uses of an object from alternatives listed by the examiner. Children were classified as reflective or impulsive from their performances on these tasks. Performances on the Unusual Uses Task were used to evaluate divergent thinking. From scores on the M F F T, children were also classified as reflective or impulsive. A nonextreme classification category was used for those who did not fit into either the reflective or impulsive category.

The authors listed three possible explanations for the lack of relationship between reflection-impulsivity and divergent problem-solving ability. The first suggested that the Unusual Uses test may have lost some validity as a measure of reflection-impulsivity, because it allowed subjects unlimited time to respond. The second suggested that in line with the instructions of the divergent task, it may have been that reflective students were able to loosen their criteria for selecting responses. Third, the existence of a loose criterion for selecting responses may have been unimportant but necessary in divergent problem solving, which may have placed great emphasis on strategies for generating alternatives. Results of the study suggested that these findings on the reflection-impulsivity measure may be useful in explaining individual differences in the flexibility of response selection criteria.

Mann (1973) tested the hypothesis that the dimension of reflection-impulsivity in problem solving is related to caution in decision making. The research took place in Sydney, Australia with a sample of 6- to 8-year-old children. Research results were consistent with the hypothesis that reflective children took longer than impulsive children to decide alternatives; however, no differences was found between the two groups in quality and content of decision making. The author also reported from his findings that in grade school children, the tendency to be reflective in problem solving is also highly related to taking longer in decision making. The differences between 8-year-old subjects and 6-year-old subjects in latency and quality of decision were very insignificant.

Reflection-Impulsivity and Self-Control

Areas of performances by students which relate to self-control and self-regulated behavior seem to show some correlation with reflection-impulsivity. Finch (1975) made reports from the examination of two related variables with reflection-impulsivity. The related areas that were examined with a group of 78 emotionally disturbed children included locus of control and persistence behavior. The M F F T was used to measure reflection-impulsivity, and the Norwicki-Strickland Locus of Control Scale was used to measure locus of control. Another measure consisting of four multicolored cubes and commercially known as "Instant Insanity" was also administered. Results of the study showed that with increasing age these children stuck to difficult tasks longer, made fewer errors on the M F F T, and were more internal than the external subjects. Girls made slower responses on the M F F T than did boys. A high correlation was found to exist between persistent behavior and latency on the M F F T. While individuals who were classified as externals responded more quickly and made more errors on the M F F T, latency and errors for all subjects were positively correlated.

As an explanation for clarity, the authors stated that test latency on the M F F T was related more to the duration of persistence. Persistence was not significantly related to errors on the M F F T because of the involvement of other factors. Nonetheless, persistent behavior was found to be related to reflection-impulsivity. Locus of control was found to be positively related to the degree with which external subjects were more impulsive in their cognitive tempos.

In other research of a similar nature (Kagan, 1965b), two different situations were presented to 60 boys and 53 girls to test the general tendency of a fast or a slow response. One measure consisted of perceptual matching tests in which response alternatives were fixed and presented to all subjects in an objective manner. In the second response, alternatives had to be generated mentally from a tachistoscopic recognition task. The scenes from the tachistoscope test required a long response time. The author reported that speed of decision making is a pervasive characteristic that can influence performances in many test situations. As a follow-up measure, months later, subjects were required to select from a large array the one stimulus that matched a standard as response time was recorded. This was in the form of two perceptual matching tests. Response time on the matching tests and tachistoscopic scenes were positively correlated. In addition, long response times and the completeness of the children's drawings of the tachistoscopically presented scenes were positively correlated.

Lack of paying attention seems to have had some effect on impulsive subjects as they perform tasks. In fact, this variable might be attributed to the reason that impulsive subjects respond so quickly. There seems to be a positive correlation between their cognitive styles and their achievement in school. Thus, the authors in this study (Hallahan, Kauffman & Ball, 1973), investigated three hypotheses concerning cognitive tempo and attention of low-achieving sixth-grade boys. When compared to high achievers, low achievers had difficulties in selective attention. The cognitive style of low achievers was much more of an

impulsive nature than it was for high achievers. A definite correlation was found to exist between selective attention and reflection-impulsivity. An I Q of between 90 and 110 was required to include these sixth grade subjects in the study, and they had to be in their appropriate grade for their age level. Tests used in the study were the M F F T for determining cognitive tempo and Hagen's Central-Incidental test for assessing selective attention. One session was sufficient to administer both tests. The attention task requested that subjects observe a card with black line drawings of an object and an animal; however, subjects were informed that only the animals were important. Central learning scores and incidental scores were derived from this task. The only other scores used in the study were from the M F F T.

Results of the study showed that high achievers attended better selectively and were more reflective than low achievers. No significant difference was found to exist between low and high achievers on irrelevant information; however, more relevant information was recalled by high achievers. A positive correlation was found to exist between selective attention and cognitive tempo.

In another study investigating selective attention in second, fourth, and sixth grade children, the stimuli used consisted of the same measures mentioned above--Hagan's Central Incidental Test and the Matching Familiar Figures Test (Hallahan, Kauffman & Ball, 1973). In the central learning measure six cards were used; each contained a black outlined animal drawing paired with a household object. The subjects were allowed 12 central learning trials, but after seeing the array for 6 seconds, they were shown cue cards of the central

component. The location of the animal on the card viewed was the task asked of the subjects. The Central learning score was derived from the number of cards on which the animal was correctly identified. After viewing horizontal rows of six cards with household objects, the subject was to pair correctly the object cards one at a time with the central stimulus to which he had been previously exposed. The score for incidental learning was the number of pairs that the subject could correctly identify. The M F F T was used to determine reflection-impulsivity. From results, the authors reported that impulsive subjects did not appear to have attended selectively; however, reflective subjects showed a decline with age in incidental learning while impulsive subjects showed an increase with age on the same measure.

Reflection-Impulsivity and Negative Versus Positive Reinforcement

Researchers, too, have shown interest in investigating negative experimental conditions that are associated with reflection-impulsivity. Often children respond more accurately under conditions with the thought of fear and failure than they do under conditions with praise and tangible rewards. Brodzinsky and Rightmyer (1976) observed and rated facial expressions of third and fourth grade students as they answered items on the M F F T. The researchers concluded that there were no significant differences in affect scores among conceptual tempo groups in response to correct choices on the M F F T. It was noticed however, that reflective students showed much more displeasure when their choices were incorrect. In addition, girls seemed much more displeased than did boys with

incorrect choices.

In other studies, the results of failure for students have produced positive results. Massari (1972) involved 28 lower-class black male first grade students in a study that included positive and negative social reinforcement. The author concluded that a high density of negative feedback induced both reflective and impulsive children to make fewer errors than did positive feedback. The author stated that under each condition, reflective students performed better than did impulsive students, but in the negative condition, impulsive students performances were similar to that of reflective students in the positive condition.

In another study of a similar nature, the investigator (Hemry, 1973) attempted to assess the effects of several reinforcement conditions on a discrimination learning task with a group of 260 first grade males in the Lawton, Oklahoma Public Schools. The M F F T was administered to the subjects to determine impulsivity or reflectivity. The procedure and order for administering this test was the same as used by Kagan (1965b) and mentioned earlier. The subjects were assigned to one of six groups. The discrimination-learning task was a picture-pairs task. The punishing condition was a manually operated two-coil 6-volt buzzer. In the reward condition a tube was used to empty pennies into a plastic cup. Three treatment conditions involving verbal reinforcement were used. In the verbal reward condition (also called right blank), each subject was told when he was right after correct responses and no comment was given in the event the subject was incorrect. In the verbal punishment condition (also called wrong blank), the experimenter told the subject that he was wrong after incorrect

responses, but no comment was given for correct responses. In the verbal reward plus punishment condition (right wrong), the experimenter commented "right" after correct responses and "wrong" after those responses which were not correct. In the blank-sound condition (nonverbal punishment), a buzzer was sounded for one second after each correct response. In the money-sound condition a penny was given and the buzzer was sounded after correct responses.

The differences that were significant between reinforcement groups showed that subjects in the reward-blank condition showed the poorest performance. Nonetheless, for all groups, the best performances were produced under the punishment and the reward plus punishment conditions; hence, the reward conditions produced poorest performances. But, as in many other studies, findings in this study showed that reflective subjects performed better than impulsive subjects.

Messer (1970) believed that a positive correlation existed between anxiety when taking tests and the intellectual capacity of subjects, which is thought to effect scores on the M F F T, thus becoming a factor as to whether a subject is classified as reflective or impulsive. In this study Stanley (1970) conducted research which allowed children to fail on an intellectual task at which time scores were taken on the effects failure had on decision time and match-to-sample performances. It was seen that failure caused both reflective and impulsive subjects to take longer amounts of time to make decisions.

Relationships between Anxiety and Reflection-Impulsivity in Task Performances

High levels of test anxiety have been found to interfere with performances on difficult tasks in some situations. Investigators (Bush & Dweck, 1973) were interested in determining whether highly reflective subjects would exhibit superior performances on such tasks; that is, whether they would at the expense of accuracy perform flexibility versus continued caution. Fifty-four girls and forty-six boys enrolled in the fourth grade were the subjects. These subjects were presented with speed tasks of increasing difficulty. Fast-accurate and slow-inaccurate subjects were not included in the study. The testing sessions included three tests that stressed quick decision making. Each test was designed so that no child could finish it before the allowed time had passed. Instructions given to the children cautioned them that the examiner was interested in the number of items that could be answered correctly. The first task was a letter symbol substitution test. The second was a digit-symbol substitution test taken from the B D form of the nonverbal test that had been used as a group intelligence test for 8- to 11-year-old children. The third task consisted of two practice items and 24 test items from Raven's Coloured Progressive Matrices.

Results of the study revealed that high-anxious reflective subjects performed as well as low-anxious reflective subjects; nonetheless, both of these groups were generally faster and more accurate than impulsive subjects. Overly cautious behavior and impaired performances on the most difficult task were believed to have been caused by reflectivity in combination with high anxiety for girls in the study.

Reflection-Impulsivity and Classroom Behaviors

In many classroom situations, the classroom teacher is thought to have an effect upon the children whom she teaches and in the manner that she demonstrates her own conceptual tempo. In an investigation in this area, Yando and Kagan (1968) included 80 first grade girls and the same number of first grade boys in a randomly selected group with 20 teachers, half of whom were impulsive, with the remainder being reflective. Children who were taught by reflective teachers tended to be more reflective at the end of the school year than did other children. Boys showed more reflective behavior than girls. The authors stated that reflective teachers reinforced inhibitions and delay as students worked on tasks. Kagan (1965a) also implied that some of the difficulties that boys experience in reading could be attributed to impulsive attitudes over which the classroom teacher may have some influence. This was found to be less prevalent in girls of the same age.

In group and classroom situations where children are six years old and sometimes younger, tendencies to be reflective or impulsive exist when responding to problems with uncertainties. Kagan (1965a) confirmed this notion in research with 76 boys and 76 girls who were classified as reflective or impulsive during their first year in school. When performances on three inductive reasoning tests were assessed, and even when verbal ability was controlled, impulsive children responded much more quickly and made many more errors than did their reflective classmates.

In research focusing on other types of classroom performances involving several measures, a high correlation was found to exist between impulsivity, creativity, rapid completion of classroom quizzes, risk taking and low caution (Joesting & Joesting, 1973). This conclusion was made from the evaluation of four measures which involved 22 graduate students. Scores were obtained on Torrance's What kind of a Person are you measure, Gordon's Personal Inventory, The Maudsley Personality Inventory, and a rating of creativity and the speed that subjects employed to complete a quiz.

Reflection-Impulsivity and Memory

Being able to recall details as a result of prior visual exposure seems to contribute to a reflective tempo. This behavior may involve both memory and mental associations. Researchers Siegel, Kirasic and Kiburg (1973) sought to test recognition memory in 8 reflective and 8 impulsive black preschool children. The Kansas Reflection-Impulsivity Scale (K R I S P) was used because it had been designed to be used especially with preschool children, and for the children in this study even the simplest version of the Matching Familiar Figures Test appeared too difficult. However, the K R I S P was based on items of the M F F T. The purpose of the study was based on the assumption that if reflective preschoolers made superior performances on a forced-choice recognition memory task in which feature differences were manipulated systematically, it was believed that subjects would demonstrate an even greater tendency to perform superiorly on tasks involving detailed featured analysis of stimuli. The recognition memory task that was administered consisted of two decks of

cards with 80 cards in each deck. One deck was termed the presentation deck which had black line drawings of an animal or an object on each. In the test deck, two black line drawings were on each card. Scores for the memory task were obtained by recording the total time that was taken to look through the presentation deck. This activity was done independently after instructions had been given. In the test deck, the subject was requested to view each of the cards and point to the one of two pictures on each card that had been seen in the presentation deck. Four experimental memory conditions were conducted which included the use of these two decks.

Results of the study showed that the mean K R I S P latency scores for boys and girls did not differ significantly. The K R I S P was found to be an adequate instrument to assess reflection-impulsivity. Subjects who made fewer errors on the K R I S P tended to respond correctly on more of the 80 test items. It was indicated that verbal labeling aided in recognition performances in preschool children. Performance was highest in the condition which allowed for successful performance by permitting subjects to label the stimuli during the original presentation.

In another study, two of the same researchers (Kilburg & Siegel, 1973) investigated memory in young children, but in this study 18 reflective and 18 impulsive children of two different grade levels were included. They were first and fifth grade students who were tested in a forced-choice recognition memory task. The specific purpose of this research was to demonstrate the differences between performances on tasks of visual analysis and tasks of

forced-choice recognition memory in which feature differences are manipulated systematically. It was believed that reflective and impulsive subjects in the first and fifth grades would differ significantly.

The classification of reflective and impulsive subjects was determined by use of the M F F T. The measures classifying recognition memory consisted of 2 decks of laminated cards, each containing 80 cards. One was the initial deck, the other, the test deck. The test deck had black line drawings of 2 figures on each card, while the initial deck contained only one figure drawing. Subjects were to view the initial deck and then determine the test items that they had remembered seeing in the initial deck. The latency for the response as well as its correctness was recorded. The time between stimulus presentation and selection was recorded. Four experimental conditions were performed using twenty of these cards in each experimental condition.

The authors reported that latencies on the M F F T were significantly related to the other latency measures, but were unrelated to correct choices in any condition. It was also reported that both reflective and impulsive subjects tended to utilize the same feature analysis process, but reflective subjects observed much more closely. Order of condition difficulty indicated that visual feature analysis without the verbal process enabled the subjects to be successful in recognition memory performances.

Reflection-Impulsivity and Role-taking Behavior

Often children in primary grades become involved in role-playing activities, at which time reflective and impulsive behaviors play some part in the manner that roles are assumed. In role-taking behaviors, a child takes the point of view of another; this is a characteristic of normal child development. However, there is thought to be a relationship between role taking and cognitive development (Glenwich & Burke, 1973). These authors stated that a significant relationship existed between egocentrism and impulsivity. It was also reported that comparing alternatives in matching figures closely conceptualized components of effective role taking. Both activities have in common the ability to coordinate simultaneously and contemplate different elements of a stimulus array. The subjects in this study by Glenwich and Burke (1973) were 53 fourth grade students who were administered the M F F T to determine reflectivity or impulsivity. Chandler's test of egocentrism measured role-taking abilities. Scores could range from high nonegocentric to highly egocentric. An interpretation of the data concerning males showed that reflectivity appeared prior to both role-taking and mediated role-taking behaviors. In other words, in order effectively to assume role-taking activities, a general disposition to reflect and ponder alternatives must exist.

Reflection-Impulsivity and Intelligence

Plomin and Buss (1973) stated that when measuring cognitive style, intelligence must not be omitted, for the two are thought to be positively correlated. These investigators were interested in the correlation of the Matching Familiar

Figures Test with the Weschler's Intelligence Scale for Children (W I S C). The subjects were fifty-two second grade students who attended a private parochial school. Since the order of testing seemed to be important, one half of the subjects were given the M F F T first and the other half the W I S C first. The authors assumed that the W I S C affected the cognitive style of the subjects and caused their scores to be more reflectively represented on the reflection-impulsivity dimension. Results suggested that if the M F F T is to be a valid measure of reflection-impulsivity in conjunction with the W I S C, it should be given first. The W I S C did not show any effect because of its order; therefore, order did not apply to it. A significant negative r between errors on the M F F T and performances on the I Q test was shown. Two main facts were presented from the study concerning reflection-impulsivity and intelligence. First, there was a reliable relationship for performance I Q, but there was none for verbal I Q. Hence, several performance subtests on the W I S C seemed to have tapped the same abilities as the Matching Familiar Figures error scores.

In another study involving I Q, the researchers were interested in re-assessing the relationship between response speed, errors, and I Q in both boys and girls. They wanted to compare these findings with similar findings in the same area. Subjects in the study were 50 boys and 50 girls who were all in the third grade. The Otis-Lennon Mental Ability Test was used to asses I Q. Other tests used in the study were the M F F T, the Picture Story Task and the Toy Choice Task. Kagan's version of the M F F T was used with nine additional sets of pictures which the experimenter designed. These were similar to

the others on the M F F T. In the Picture Story Task, subjects were asked to tell a story about six pictures selected from Teaching Picture Series. Portrayed were children of various countries engaging in activities typical to their own homeland. The first was a practice item. Scores on this task were derived by recording the subject's response latency from the time the picture was placed before him until he finished looking and talking about it. In the Toy Choice task, the subject was allowed to choose from a large selection of toys the one with which he would want to play. The toys were covered before instructions were given. Response latency was recorded from the time the subject viewed the toys until his selection was made. Numbers on the M F F T were found to be more a function of latency for boys than it was for girls. A significant correlation between I Q and latency was found on the M F F T for both boys and girls. Nonetheless, response-style stability between the M F F T task and the Picture Story Task was shown for girls, but not for boys. However, there was no evidence of commonality in conceptual tempo across the three tasks.

In relationship to I Q and other hereditary and environmental factors, young children often seem less able than older children to process information. Nuessel (1972) investigated the relationship between differences in hypothesis-testing of a developmental nature and the methods that children at two age levels employed in problem solving. In this study, Levine's Task was used to assess the relationship between reflection-impulsivity and proficiency of focusing. If a subject had a reflective problem-solving style, it was believed that he would be able to process information more effectively than one who had an impulsive

problem-solving style. Subjects in the study were children of middle-class background. Forty of them were in the fifth grade and the others were in the ninth grade. These subjects were chosen because of their responses on the M F F T. Each subject was tested with a series of 16 simultaneous concept identification problems. In the training sessions, subjects were informed of the 8 simple hypotheses that were the only possible solutions to each problem. The experimenter recorded each stimulus choice and gathered two measures of response latencies from each subject.

The most prominent source of differences in focusing ability was found to exist on data reported on grade levels. In this instance, focusing refers to the efficiency with which feedback information was used to solve the concept identification problems. In conclusion, focusing abilities of fifth-grade students were not as efficient as that of those in the ninth-grade. Fifth-grade students also had shorter latencies that were found to be associated with more inefficient and less proficient focuses. Moreover, developmental differences in focusing was thought to be related to developmental differences in reflection-impulsivity. With Levine's task used as a measure of evaluation, it was revealed that a reflective style was highly related to focusing because it provided for more effective retrieval and recording of information.

Reflection-Impulsivity and Motor Behaviors

As has been discussed, many factors contribute to the conceptual tempo with which young children demonstrate performances. Often the impulsive attitude in one situation may be less prevelant in another. Poor control of motor

behavior correlates with inadequate control of other important behaviors in young children. In studying motor behavior control in black preschool children, Harrison and Nadelman (1972) reported that conceptual tempo was more highly related to the ability to inhibit movement than to the number of errors on measures of reflection-impulsivity. However, more reflective children were able to inhibit motor movement upon request than were impulsive children, as measured by the Maccoby et al. Draw a Line Slowly and Walk Slowly Tests.

In agreement with these findings, Meichenbaum and Goodman (1969) investigated verbal control of motor behavior as it was related to children. Under overt and covert self-instructional conditions, subject's verbal control of the words "faster" and "slower" were examined on a finger-tapping response, and "push" and "don't push" on Luria's Depression Task. Results showed that impulsive subjects responded more readily to self-instruction in a motoric manner.

Bentler and McClain (1976) in measuring the relationship between reflection-impulsivity and motor inhibition, found that these skills were significantly correlated with reflectivity and with ratings by teachers of introversion and anxiety in the subjects. The data were gathered by measuring children's ability to draw a line and to walk slowly. The subjects were 66 first grade boys and girls of middle-class background.

Reflection-Impulsivity and Eye Movement

Improper eye movement seems to have been one of the chief reasons that impulsive students fail to consider details on the M F F T, as well as on other

tests in which variants must be compared to a standard. This kind of eye-movement has become a major factor when young children make analogies and comparisons on the M F F T and other tests. It has been found (Ault, Crawford, & Jeffrey, 1972; Drake, 1970) that eye movement played an important role in scanning procedures, thus helping to determine impulsivity or reflectivity. Ault, Crawford, and Jeffrey (1972) reported that visual scanning procedures of fourth grade students were recorded as they took the M F F T. They discovered that fast-accurate students were more systematic and made more comparisons between the standard and variants. All of the subjects applied the same basic procedure for making comparisons between the standard and the variants, but reflective students were proven to have been much more attentive than were impulsive students during task performances.

In another study, impulsive and reflective third grade students and college students took the Modified Matching Familiar Figures Test; eye fixation was recorded with the use of Mackworth's eye-marker camera (Drake, 1970). Reflective third grade subjects and impulsive college subjects were reported to have analyzed the standard many more times and in much greater detail than other subjects. Adults were reported to have been much more reflective than the third grade students.

In studying the observing behavior of 100 reflective and impulsive fourth grade Caucasian boys (Siegelman, 1969), three components of the observations were recorded. As students performed for a second time on the administration of the Modified Matching Familiar Figures Test, the behaviors observed

were frequency, duration, and target of observation. Results showed that more than twice as many alternatives were ignored by impulsives than reflectives, meaning that impulsives used both a more biased and a more peaked distribution of attention. Nonetheless, in the area of attention, reflective students devoted less looking time as well as fewer looks to the standard, to the most observed alternative, and to the chosen alternative than did impulsive students. However, reflective subjects had higher mean scores on all measures of frequency and durations of looking behavior.

In a similar investigation, nine-year-old subjects performed three tasks as their eye movements were recorded in research by Zelniker, Jeffrey, Ault, and Parsons (1972). The tasks included the M F F T, Differentiating Familiar Figures Test, and a second task of Matching Familiar Figures Problems. From the data on eye fixation for both impulsive and reflective subjects, it was revealed that they focused increasingly on comparisons of the variants, and decreased their percentage of fixations on the standard. Data from reaction time tasks with variable preparatory intervals showed that with long preparatory intervals, impulsive subjects had shorter reaction times than reflective subjects. This was an indication of the poorer ability of impulsive subjects to sustain attention.

McKinney (1973) was concerned with scanning strategies and eye focusing strategies as well as with the combination of the two approaches, as used by second grade students. Only 73.33% of the thirty reflective subjects used a focusing approach on each trial as compared to just 33.33% for impulsive subjects. Moreover, 55.55% of the impulsive subjects used either a random or a mixed

strategy as compared to 25.55% of the reflective subjects. The author concluded from the data analysis that impulsive students often performed on a trial-error basis and that they were often less likely to employ strategic abstract hypotheses. Nonetheless, reflective subjects employed more hypothesis testing strategies.

Reflection-Impulsivity and Training Procedures and Techniques

Many studies in the literature deal with methods used by investigators in training impulsive stubjects to become more reflective. It appears that the reflective tempo has more advantages for the individual as he operates in large and small groups--grasping concepts, making decisions, and interacting with peers. A variety of methods has been used for training; however, not all have achieved the same degree of success. In some instances, training takes place when the child begins formal instructions in school, while in other cases, subjects are in elementary, junior high, or high school when they have experienced training in reflectivity.

A technique for training impulsive children was investigated by Debus (1970). This method consisted of permitting third grade impulsive students to observe sixth grade impulsive and reflective students as they responded to items on a visual discrimination task. The results showed that those students who observed reflective sixth grade models showed an increase in response latency on an immediate posttest. These children also made significantly fewer errors. It should also be noted that third grade girls who observed a sixth grade model as he changed from reflective to impulsive behaviors while completing tasks also

showed increases in response accuracy and latency. These increases were shown to have been maintained even two and one-half weeks later when a posttest was given.

The cognitive tempos and conceptual styles of 231 second grade boys were changed by the effects of observing female adult models perform conceptual tasks (Denney, 1972). Two cognitive style dimensions which differed for modeling conditions were used, these were analytic versus relation conceptual styles and reflective versus impulsive cognitive tempos. The relational model was reported to have produced more absolute changes on an immediate posttest; however, a follow up test showed that more permanent changes were found to have resulted from the analytic modeling condition.

There of course, has been much interest in the technique of observation for training impulsives. Ridberg, Parke, and Hetherington (1971) exposed 50 impulsive and 50 reflective fourth grade boys to film-mediated models who showed cognitive styles that were opposite of their own. The authors were interested in evaluating verbalization of styles and demonstrations of scanning strategies. They were interested in modifying cognitive styles by evaluating these two processes. Results of the study reported that high-I Q students showed high results in viewing models who displayed scanning or verbal cues alone, while low-I Q students benefited most from the techniques of viewing, or a combined use of scanning and verbal cues by models.

Other researchers believe that the impulsive attitude has its beginning during the preschool years and they have stated that around this time, steps to

modify this behavior should begin (Kagan, Pearson, & Welch, 1966). Two different tutoring groups consisting of 20 subjects each were used to train first-grade impulsive subjects. In one training group, the subject was persuaded that he and the trainer shared some special characteristic and interest. Subjects in the second group of first graders were not treated in any way to show that they shared qualities and characteristics which existed among the trainer and themselves. Results showed that both groups showed significant latencies in their responses after the training. However, girls in the group that was led to believe that they shared qualities similar to those of the trainer showed greater results in latency scores and correct responses on the posttest of the M F F T than did boys in the same group.

Other investigators (Meichenbaum & Goodman, 1971) sought to seek measures to train fifteen second grade impulsive subjects by the use of a cognitive self-instructional training procedure that involved two studies. In the first study, attempts were made to aid the subjects in increased self-control by having them talk to themselves, first overtly and then covertly. In the second study, the experimenters sought to measure the degree to which the cognitive treatment was effective in altering the impulsive subjects' performances on the M F F T. Results of the studies showed that subjects' reponse time was slowed down greatly by the method of cognitive modeling.

Second grade subjects were involved in a training investigation (Egeland, 1974) in which one group of impulsive subjects received training enabling them to use more efficient scanning techniques, while a second group was taught to delay

their responses by using the same materials. These materials used for training consisted of match-to-sample visual-discrimination exercises. After training, both groups were administered the M F F T which showed that significant increases in response time and decreases in errors were experienced by all subjects. After two additional months, a posttest was given. The results indicated that the group trained to delay responses showed an increase in errors, while the group trained to improve search strategies maintained a low level of error responses. Both groups showed improved performances on the vocabulary subtest of the Gates MacGinitie Reading Test while a control group did not show any significant changes on any of the above-mentioned measures.

It has been suggested that the differences in cognitive styles by lower-class and middle-class students were related to the way that these groups varied in strategies for processing information (Heider, 1971). Heider (1971) conducted a study that had as its purpose the comparison of the effectiveness of three methods of modifying an impulsive tempo. These three methods included enforced delay of response, increased anxiety over errors, and the teaching of proper task strategy. Two experimental groups were organized. The first included 40 middle-class and 40 lower-class nine-year-old boys. Subjects were assigned randomly to the four conditions of tasks instructions in both experiments. The task for the first experiment was the M F F T. The task included in the control condition involved requiring subjects to find the variant that was identical to the standard. Subjects were allowed to choose until the correct response was chosen. In the second condition, a 35-second timer sounded before subjects

were allowed to speak concerning their desired response. The third condition involved increased motivation when subjects were told toys would be waiting for them to play with if few errors were made. In the fourth condition, subjects were cautioned on techniques for eye movement. In the second experimental group, the same procedures were followed, but instead of using the M F F T as a measure, a language task was used. Subjects were given the same four instructional conditions as were given to the first group, except that this group was required to make a sentence using five given words. These words were two nouns, two verbs, and one pronoun.

In comparing results by lower-class and middle-class subjects, it was shown from the study that lower-class subjects were indeed more impulsive than middle-class subjects. Neither of the three experimental conditions has a significant effect on the middle-class group. Heider (1971) suggested that perhaps tasks were much easier for this group than for the lower-class group. Only task strategy instructions increased the response time for lower-class subjects. This same condition also produced the greatest decrease in errors for these subjects.

One reason for attempting to alter rapid responses on the reflection-impulsivity continuum is to alert educators to the awareness of a child's cognitive tempo so that they might initiate the creation of more optimal learning conditions in the classroom. Teaching can be adapted to a child's preference for processing information learning situations (Briggs & Weinberg, 1973). The researchers sought to discover whether the speed at which impulsive children responded

could be modified through manipulative activities during training sessions. This study was concerned with helping impulsive subjects to lengthen responses and on the other hand, helping reflective subjects to shorten the latencies of their responses. The subjects were 145 fourth grade boys. In addition to selecting a reflective and an impulsive group, a middle group was also selected whose criteria scores on the M F F T were at or near the intersection of time and error medians.

To determine the effects of the training sessions, subjects were given pretest and posttest batteries which included a draw-a line task, aimed at assessing a subject's ability to control a motor response. The last seven items on the Wechsler Intelligence Scale for Children, a cognitive task involving picture arrangements, were administered. Evaluations used were total time spent on errors; points scored were not tallied. Briggs and Weinberg (1973) quoted Kagan et al. (1964) as stating that this test has been found to be more related to the reflection-impulsivity measure than to verbal intelligence. The last supplementary measure was a perceptual task in which subjects were required to produce tones ranging in length from 1.5 to 5.5 seconds by pressing a telegraph key. The researchers believed that this task was likely to be influenced by training in reflection-impulsivity. The posttest battery consisted of administering the M F F T with alternatives rearranged to control for memory of position and also re-administering the same three pretest tasks. The training tasks consisted of 17 sets of line drawings of complex geometric figures. This task was designed with the same general principle as the M F F T except there was no

matching to the standard.

Results of the study showed that greatest effects of modifying responses were shown by the reflective group. Hence, subjects who were trained to become reflective made considerably fewer errors than did those who were trained to respond quickly. Consequently, all subjects showed improvements on the M F F T posttest; however, the impulsive group displayed the most considerable changes.

It seems that boys possess more of a hyperactive conceptual style than do girls, and the focus of many training experiments have been on boys rather than girls. Palkes, Stewart, and Kahana (1963) reported that a group of twenty hyperactive 9-year-old boys were trained to establish self-control of voluntary behavior. As a pretest measure, the Porteus Maze Test Revision Series was administered. Subjects in the experimental group were directed to verbalize a set of commands to themselves before attempting to respond to any task. The subjects in the control group were not given any instructions. At the end of the training sessions, the subjects were again given the Porteus Maze Test Revision Series that indicated that self-directed verbal commands had helped to modify the hyperactive impulsive behavior that these boys had previously displayed.

As can be seen from the studies and investigations presented on training impulsive subjects, this process is of great concern to those who are interested in children. Those who seemed to have made the most significant changes as a result of reflection-impulsivity training appeared to be students who were in the primary grades in school. Many training sessions seemed to have been very

effective even though they had been implemented in short periods of time--two weeks, four weeks, two months, etc.

Summary

In summary, the research presented on the effectiveness of training impulsive students to become more reflective has great value. Helping to modify the impulsive attitude will enable young students to become more accurate as they participate in tasks which involve thought and consideration. The investigator has placed emphasis on numerical training concepts, because they involve some of the activities that primary grade students encounter in their daily classroom activities.

Evidence of the impulsive attitude has been observed among mothers and their young children (Campbell, 1973), implying that the impulsive nature of a mother is somehow transmitted to her own children through direct associations and parenting behaviors. Studies have shown that the impulsive conceptual tempo is a disadvantage to young children in many areas such as mathematics manipulations (Cathcart & Liedtke, 1969), reading sentences (Otto & Fredricks, 1963), and inductive reasoning (Kagan et al., 1966). In the area of reading, a high correlation was found to exist between errors on word recognition test and errors on the M F F T (Kagan, 1966). Those students who exhibited personalities characterized by making hasty decisions (Block & Peterson, 1955) and engaging in risky and dangerous situations, were also classified as possessing impulsive cognitive tempos, from scores on the M F F T. The impulsive attitude was also found to have been a disadvantage to students as they performed in classroom

situations (Kagan, 1966).

One factor that has become a concern in studying reflection-impulsivity is improper eye movement when making analogies and comparisons (Ault, Crawford & Jeffery, 1972; Drake, 1970). Siegelman (1969) reported that impulsive students ignored twice as many alternatives as did reflective students. This researcher also reported the impulsive students were observed to have had a tendency to focus increasingly on comparisons of variants, and to have decreased their percentage of fixations on the standard.

Training procedures and techniques are some ways to help impulsive students to become more reflective. Modeling proved to have been an effective technique for training in reflectivity as it was used in research studies by several investigators (Debus, 1970; Denny, 1972; Ridberg, 1971). Other investigators were successful in modifying the impulsive conceptual tempo by using the method of self-instruction (Meichenbaum & Goodman, 1971). Training in more efficient scanning techniques and delaying of responses were reported (Egeland, 1974) to have aided impulsive subjects greatly in becoming more reflective. Denny (1973) conducted research training impulsive children in more effective constraint seeking kinds of questions that were significant in helping them to achieve a more reflective conceptual tempo. Heider (1971) conducted research using three methods of helping to modify an impulsive tempo. These included enforcing delay of responses, increasing anxiety over errors, and the teaching of proper task strategies. Lower class subjects benefited greatly from the training, but the middle class subjects benefited only slightly.

Of the training techniques presented, all have received some degree of success for the students involved. The investigator believes that through research studies on reflection-impulsivity, those who work with young children will gain information on ways of creating optimal learning situations. The investigator also believes that modification of impulsive attitudes will become a feasible objective of educators as they plan for individual differences among young school children.

CHAPTER III

METHOD

As a result of the findings reported in the survey of the literature on reflection-impulsivity and modifying this behavior, the current study was designed to examine more extensively conceptual tempos in kindergarten and second grade students, through the techniques of self-verbalization and delayed responses techniques while completing one-to-one correspondence tasks. This chapter gives a more detailed description of the design of the study, including the methods of procedure, and the analysis of data.

Design of the Study

Subjects

The subjects in this study were selected from students who attended the kindergarten and the second grade at Allenbrook Elementary School in Charlotte, North Carolina. In keeping with the racial composition of the city of Charlotte, the schools had developed an integration ratio plan so designed that thirty percent of the students who attended this school were black and seventy percent were white. Most of the students lived in the neighborhood where the school was located. According to social class status, as assessed by the school system, the majority of the students were considered to belong to the lower middle social class. All of the 125 kindergarten students and all of the 135 second grade students who attended this school were involved in the study.

Setting

The testing and tasks manipulations took place in a small classroom down the hall from the students' original classroom. Subjects were escorted from their classroom to the testing room by the examiner. In the classroom used for testing, there was a table large enough for all objects to be spread out for very easy manipulations. The examiner was seated on one side of the table, while the subject was seated comfortably in a child-sized chair on the other. Only one subject at a time was permitted to perform the tasks. Therefore, throughout the task and testing sessions only the examiner and the participating subject were present in the classroom. Each session lasted no longer than fifteen minutes. As soon as the sessions ended, the subject was dismissed and escorted back to his/her classroom. He/she was thanked for participating, but no mention of performances was made.

Design

This study was designed using a 2 x 3 x 2 analysis of variance design. The between subject factors were grades (kindergarten and second); original cognitive tempos (reflective and impulsive) and training instructions (self-verbalization and delaying of responses). The 2 x 3 x 2 design was used in order to divide the combinations into sets that were balanced with respect to the main effect of the factors involved in the study (Winer, 1962). Winer (1962) stated that this balance should adhere to all two-factor interactions.

Materials

The two tests to be used in this study are described in the following paragraphs.

Henmon-Nelson Test of Mental Ability. The primary form of the Henmon-Nelson Test of Mental Ability was used to determine if students possess the general mental ability and aptitude to complete successfully activities that were included in the study, and at the same time to benefit from the experiences that were provided by the study. Nelson and French (1973) stated that this test was designed to measure aspects of mental ability that are important for success in school work. The scores could either be interpreted as measures of general ability or as aptitude. If a student made a high score on the test, it was indicative of the fact that verbal and numerical symbols had been efficiently utilized and it also showed evidence of the ability to acquire and retain information in the form of common symbols.

This test contained three subtests that were referred to as the Picture Vocabulary Subtest, the Listening Subtest, and the Size and Number Subtest.

The Matching Familiar Figures Test. The Matching Familiar Figures Test was used to assess cognitive impulsivity (Kagan, 1966). Subjects were administered both pretest and posttest with different versions of the Matching Familiar Figures Test. When taking the M F F T, subjects were required to select from several variants one picture that was identical to the standard. The number of errors made and the tendency to exhibit fast or slow decision time

were used to assess the degree of cognitive impulsivity. Those subjects who were above the median on total errors and above the median on total response latency were classified as impulsive. On the other hand, those subjects who score below the median on errors and above the median on response latency were classified as reflective.

The training sessions were begun one week after testing as was done in studies by other investigators who used training sessions after testing (Meichenbaum & Goodman, 1971; Briggs & Weinberg, 1973). In the study by Denny (1972), training and posttest sessions were conducted one week after the pretest session. Egeland (1974) conducted research in training subjects in which the posttest was administered immediately after training. In this study the post-test was also administered immediately after the subjects had completed the training sessions (see Appendix A).

One-to-one Correspondence Training Task. The one-to-one correspondence tasks used in this study were administered individually to subjects by the examiner. Six of these were used. Two were used as pretest and posttest, the other four as training tasks.

When there are equivalent sets which are arranged differently, many young children say that they are not equivalent, because they have a tendency to judge things by how they look. Often these young children answer impulsively, without even looking carefully at the two sets of objects (Lavatelli, 1970). During the training in one-to-one correspondence, to assure understanding, impulsive subjects were allowed to go back to the starting point in thought. As

an aid to understanding, they were allowed to place objects in each of the two sets right beside each other to show visual relationships. With the objects in direct physical relationship with one another, the subject could then touch objects as they were placed beside corresponding objects until the concept was understood.

The subjects were seen individually for four 15-minute training sessions; this involved a period of two weeks. The tasks used for training impulsive subjects in self-verbalization were also used to train additional subjects in delaying responses.

Self-Verbalization Training. The procedures for training in self-verbalizations required that the subject be cautioned by the examiner before making any responses. The examiner first performed a task while talking aloud as the subject observed (the examiner acted as a model). Second, the subject performed the same task while he was instructed aloud concerning the rationale for making responses. Finally, the subject performed the one-to-one correspondence task while talking to himself before offering a response involving a solution to questions that were asked. The verbalizations that the examiner modeled and that the subject subsequently modeled included questions about the nature and requirements of the task of one-to-one correspondence so that subjects had a clear understanding of the procedures involved. Answers to the questions involved were in the form of cognitive rehearsal and subjects were advised on pitfalls that might lead to production deficiencies.

The one-to-one correspondence tasks that were used in training were derived from those that were developed by Piaget and explained in demonstrations

by Lavatelli (1970). One-to-one correspondence tasks were used in this study, because contained here are tasks by which young children are often confronted. The tasks include sets of objects that go together in some natural way such as flowers and vases, dolls and shoes, pencils and erasers, and jars and jar lids. Children were aided in understanding that one set of objects is equal to another set. Assurance of equality was proven when children were allowed to match corresponding objects in the two sets. Lavatelli (1972) stated that matching the objects seemed to be most effective in achieving understanding of equality, and that while counting does reveal verbal numeral it is often ineffective with a great number of young children. Demonstrating with actual materials helps to extend vocabularies of impulsive children (see Appendix C).

By training impulsive young children to delay responses or to verbalize to themselves on tasks that involve one-to-one correspondence, it was believed that they would become more reflective in performing similar tasks. It was expected that they would continue to exhibit this kind of behavior in like situations when confronted with tasks of a similar nature.

Until the subject had responded to five questions asked by the examiner concerning the number of objects in the two sets, the examiner continued to add one and to take away one object from subsequent rows. Here children had some concrete experiences with which to associate more and less. This training was designed to improve task performances and to promote self-control by providing explicit contact in task comprehension, to examine the production of appropriate mediators, and to evaluate ways of employing these mediators to control verbal

behavior (Meichenbaum & Goodman, 1969). Subjects received a score for latency and a score for errors.

As an evaluation measure in determining how effective the training had been, a different task of this kind was administered before and after training.

Delaying Responses Training. The second training condition was that of delayed responses. In this condition, a timer was used and subjects were not permitted to speak until the allotted time of ten seconds had passed. However, unlimited time was allowed after the ten seconds period had passed. A timer was set to buzz when ten seconds had passed so that subjects would know that it was time for their responses. Any responses made prior to the ten-second period were ignored and subjects were reminded that the buzzer had not sounded. Subjects received a score for latency and another score for errors made.

Establishment of Groups

After successful completion of the Henmon-Nelson I Q Test, subjects were given the M F F T to determine whether they possessed a reflective or an impulsive conceptual tempo. The results of the M F F T aided the investigator in grouping so that the appropriate number of impulsive and reflective subjects could be selected for the study. The two tests were administered on different days. The I Q Test is a group test and the M F F T is an individually administered test.

Thirty impulsive kindergarten students, and thirty impulsive second grade students who qualified were assigned to one of two training groups on their

appropriate grade level. After grouping had been completed, the pretest on one-to-one correspondence was administered. Group I consisted of 15 kindergarten subjects and 15 second grade subjects who were trained individually to delay responses. Group II consisted of the same number of subjects from the same grade levels who were trained by techniques of self-verbalizations. In addition, thirty reflective subjects, 15 from each of the two grade levels were selected, but did not receive any training; however, they were administered both pretests and both posttests.

Those subjects who scored below the group average on the Mathematics subtest of the Henmon-Nelson I Q test were not selected to participate in the study, because it was believed that they would not benefit from the training. A low score was also indicative of the possibility that the vocabulary to be used in the training and tasks completion throughout the study may have been too difficult for these students.

Summary

It was believed that through training in self-verbalization or delaying of responses, impulsive subjects became able to respond more slowly and to examine more alternatives before arriving at a solution to problems with uncertainties. The method and research design discussed in this chapter provided subjects with training to help them acquire a more reflective conceptual tempo.

CHAPTER IV

RESULTS

Performances of impulsive kindergarten and impulsive second grade subjects who received training in reflectivity were compared with reflective subjects on the same grade levels who were tested to be reflective and received no training. The Matching Familiar Figures Test (M F F T) was used to measure impulsivity and reflectivity.

A comparison was made of the performances of all impulsive subjects trained to become more reflective and all reflective subjects not trained. A comparison was made of performances between impulsive kindergarten subjects who were trained to become more reflective and impulsive second grade subjects who were trained in the same manner. Further comparisons were made on post-test scores of the one-to-one correspondence test of performances by all impulsive subjects who were trained to become more reflective and those reflective subjects who were not trained. Additional comparisons were made between the groups who were trained by the delayed response method and those who were trained by the method of self-verbalization.

Tests of all hypotheses in this study involved a 2 x 3 x 2 analysis of variance statistical design. Post hoc comparisons were made to further analyze these data by the use of the Scheffé statistical computation, a multiple comparison test (Winer, 1962).

Several post hoc comparisons were made regarding the original hypotheses as a result of the statistical results obtained. The hypotheses used in the post hoc comparisons are identified by the (') symbol.

Test of hypothesis H_1 involved a group and test interaction. Hypothesis H_1 was not rejected at the .05 level (see Table 1). Data results revealed that there were no significant differences among the Matching Familiar Figures posttest means of response time for the self-verbalization, delayed response, and reflective groups.

On the errors measure of the Matching Familiar Figures Test, results of the factorial analysis of variance statistical computation revealed a significant grade and training interaction. This hypothesis (H_2) stated that there were no significant differences among the Matching Familiar Figures posttest means for the number of errors for the self-verbalization, reflective, and delayed response groups. However, data results showed that there were indeed differences among the three groups in regard to their performances on the errors measure of the Matching Familiar Figures Test as shown in Table 2.

Further data analyses were performed in regard to the rejection of hypothesis H_2. One-way analysis of variance involved post hoc comparisons using the Scheffé statistic. The following post hoc hypothesis was tested: H_2'--that there are no significant differences between the posttest means of the impulsive groups and the reflective groups regarding the errors measure of the Matching Familiar Figures Test. Data analysis showed that this hypothesis should not be rejected at the .05 level, as shown in Table 3. Therefore, it appeared that the

TABLE 1

Analysis of Performances by the Self-Verbalization, Delayed Response and Reflective Groups on the Response Time Measure of the Matching Familiar Figures Test

Source of Variation	Sum of Squares	DF	Mean Square	F
Main Effects	264043.031	4	66010.758	120.101
Grade	40840.503	1	40840.503	74.306**
Training	2627.754	2	1313.877	2.390*
(Covariate) Response Time	10860.480	1	10860.480	19.760
2-way Interactions	1448.885	2	724.443	1.318
Grade X Training	1448.885	2	724.443	1.318
Explained	265491.916	6	44248.653	80.507
Residual	45069.522	82	549.628	
Total	310561.438	88	3329.107	

*Hypothesis (H_1) not significant at the $P < .05$ level

**Hypothesis (H_2) significant at the $P < .05$ level

TABLE 2

Analysis of Performances by the Self-Verbalization, Delayed Response and Reflective Groups on the Errors Measure of the Matching Familiar Figures Test

Source of Variation	Sum of Squares	DF	Mean Square	F
Main Effects	1473.388	4	368.347	80.705
Grade	123.220	1	123.220	26.998*
Training	151.519	2	75.760	16.599**
Errors (Covariate)	94.247	1	94.247	20.650
2-way Interactions				
Grade X Training	205.907	2	102.953	22.650
Explained	1679.295	6	279.883	61.323
Residual	374.255	82	4.564	
Total	2053.551	88	23.336	

*Hypothesis (H_2) significant at the P .05 level

**Hypothesis (H_4) significant at the P .05 level

TABLE 3

Analysis of Performances by Impulsive and Reflective Groups on the Errors Measure of the Matching Familiar Figures Test

Source	DF	Sum of Squares	Mean Square	F
Between Groups	1	67.9552	67.9552	2.977
Within Groups	87	1985.5954	22.8229	
Total	88	2053.5506		

impulsive and reflective groups did not perform significantly differently on the errors measure of the Matching Familiar Figures posttest.

Results of analysis of variance factorial design indicated that hypothesis H_3 should be rejected. It was revealed that there were significant differences ($P = .05$) between performances of kindergarten and second grade subjects regarding the response time measure of the Matching Familiar Figures posttest as shown in Table 1; therefore, the null hypothesis H_3 was rejected.

As a result of the rejection of this hypothesis (H_3), additional data were analyzed using post hoc comparisons involving the Scheffé statistic. This analysis tested hypothesis H_3' which stated that there were no significant differences between the posttest means of impulsive and reflective kindergarten subjects on the Matching Familiar Figures Test response time measure.

The statistical analysis (Scheffé) indicated that hypothesis H_3' should not be rejected at the .05 level of significance (Table 4). Therefore, it was concluded that impulsive kindergarten subjects and reflective kindergarten subjects did not differ significantly on the posttest response time measure of the Matching Familiar Figures Test.

Hypothesis H_3'' stated that there were no significant differences between the posttest means of impulsive second grade subjects and reflective second grade subjects on the response time measure of the Matching Familiar Figures posttest. This hypothesis (H_3'') was formulated also as a result of the denial of hypothesis H_3. Post hoc analysis of variance computations using the Scheffé statistic revealed that this hypothesis H_3'' should be rejected at the $P = .05$ level

TABLE 4

Analysis of Performances by Impulsive and Reflective Kindergarten Subjects on the Response Time Measure of the Matching Familiar Figures Test

Source	DF	Sum of Squares	Mean Square	
Between Groups	1	567.5111	567.5111	1.752
Within Groups	43	13928.4000	323.9163	
Total	44	14495.9111		

as indicated in Table 5. Therefore, it was concluded that impulsive and reflective second grade subjects did indeed differ significantly on the response time measure of the Matching Familiar Figures posttest.

It was hypothesized that there were no significant differences between the posttest means of kindergarten and second grade subjects regarding the response time measure of the Matching Familiar Figures Test. Data results showed that scores made by kindergarten and second grade subjects on the response time measure of the Matching Familiar Figures posttest were significant at the .05 level (Table 2).

With the rejection of this hypothesis, H_4, post hoc comparisons were made to provide additional information. The post hoc hypothesis (H_4') stated that there were no significant differences between posttest means of impulsive and reflective kindergarten subjects on the errors measure of the Matching Familiar Figures posttest. This hypothesis H_4' could not be rejected at the .05 level of significance (Table 6).

Further comparisons were made as a result of the rejection of hypothesis H_4. Hypothesis H_4'' was formulated and stated that there were no significant differences between posttest means of impulsive and reflective second grade subjects on the errors measure of the Matching Familiar Figures Test. Hypothesis H_4'' was rejected at the .05 level of significance. Hypothesis H_4'' was rejected in favor of impulsive and reflective subjects performing significantly differently on the errors measure of the Matching Familiar Figures posttest as shown in Table 7.

TABLE 5

Analysis of Performances Comparing Impulsive Second Grade Subjects with Reflective Second Grade Subjects on the Response Time Measure of the Matching Familiar Figures Test

Source	DF	Sum of Squares	Mean Square	F
Between Groups	1	9797.8320	9797.8320	11.444
Within Groups	42	35959.8952	850.1880	
Total	43	45757.7273		

TABLE 6

Analysis of Performances by Impulsive and Reflective Kindergarten Subjects on the Errors Measure of the Matching Familiar Figures Posttest

Source	DF	Sum of Squares	Mean Square	F
Between Groups	1	0.1000	0.1000	0.090
Within Groups	43	47.9000	1.1140	
Total	44	48.0000		

TABLE 7

Analysis of Performances by Impulsive and Reflective Second Grade Subjects on the Errors Measure of the Matching Familiar Figures Posttest

Source	DF	Sum of Squares	Mean Square	F
Between Groups	1	113.7716	113.7716	7.100
Within Groups	42	637.0238	16.0244	
Total	43	750.7954		

Statistical computation for testing hypothesis H_5 involved an analysis of variance design. Results showed that this hypothesis could not be rejected at P = .05 level (Table 8). It was therefore concluded that there were no significant differences among the posttest means of response times on the one-to-one correspondence posttest for the delayed response, self-verbalization, and reflective groups.

Grade and training interactions involving kindergarten and second grade subjects on the one-to-one correspondence measure was tested. This hypothesis (H_6) stated that there were no significant differences among the posttest means on the errors measure of the one-to-one correspondence measure for the delayed response, self-verbalization, and reflective groups. Hypothesis H_6 could not be rejected at the P = .05 level (Table 9). Statistical analysis supported hypothesis H_6 as it was originally stated.

Grade and training interactions involving the one-to-one correspondence measure were tested in hypothesis H_6. This hypothesis stated that there were no significant differences among the posttest means on the errors measure of the one-to-one correspondence test for the delayed response, self-verbalization, and reflective groups. Results from data analysis supported this hypothesis as shown in Table 9.

Hypothesis H_7 stated that there were no significant differences between the posttest means of the kindergarten and second grade subjects regarding the response time measure of the one-to-one correspondence test.

TABLE 8

Analysis of Performances by the Delayed Response, Self-Verbalization, and Reflective Groups on the Response Time Measure of the One-to-one Correspondence Posttest

Source of Variation	Sum of Squares	DF	Mean Square	F
Main Effects	8056.559	4	2014.140	58.674
Grade	323.842	1	323.942	9.437*
Training	183.367	2	91.684	2.671**
One-to-one Correspondence Pretest Response Time (Covariate)	2589.445	1	2589.445	75.433
2-way Interactions	0.823	2	0.412	0.212
Grade X Training	0.823	2	0.412	0.212
Explained	8057.382	6	1342.897	39.120
Residual	2814.865	82	34.328	
Total	10872.247	88	123.548	

*Hypothesis H_5 not significant at $P < .05$ level

**Hypothesis H_7 significant at $P < .05$ level

TABLE 9

Analysis of Performances by the Delayed Response, Self-Verbalization, and Reflective Groups on the Errors Measure of the One-to-one Correspondence Posttest

Source of Variation	Sum of Squares	DF	Mean Square	F
Main Effects	86.478	4	21.620	27.070
Grade	1.734	1	1.734	2.171
Training	0.729	2	0.365	0.457*
One-to-one Correspondence Pretest Errors (Covariate)	73.244	1	73.244	91.708
2-way Interactions	0.503	2	0.252	0.315
Grade X Training	0.503	2	0.252	0.315
Explained	86.981	6	141.497	18.151
Residual	65.490	82	0.799	
Total	152.472	88	1.733	

*Hypothesis H_6 significant at P .05 level

Analysis of variance statistical analysis did not support this hypothesis as shown in Table 8. Therefore, it was concluded that kindergarten and second grade subjects performed significantly different on the response time measure of the one-to-one correspondence posttest. The statistical analysis results were significant at $P = .05$.

CHAPTER V

DISCUSSION AND CONCLUSIONS

An investigation was conducted to determine whether children given training in techniques of withholding responses and verbalizing to self while exercising caution in problem-solving situations which would enable them to increase response latencies and reduce errors would perform significantly differently than children who showed evidence of already possessing these skills. Understandably, children could not successfully participate in the training tasks unless they possessed the mental ability necessary to understand the mathematical concepts presented during manipulation sessions.

Performance by Groups

From the study, it was revealed that there were significant differences on the pretest and posttest scores of the Matching Figures Test for subjects who had been trained to become more reflective. There were some differences in mean scores of impulsive subjects who had been trained by the method of delayed response as compared to those trained by the method of self-verbalization. The self-verbalization trained groups had higher mean scores.

On the Matching Familiar Figures pretest, the median response time for kindergarten subjects was 48.2 seconds. The median error score for the same group of subjects was 3.2. Subjects who scored above the median in response time and below the median in errors were classified as reflective.

Even though 125 kindergarten subjects were originally involved in the study, only 96 subjects in this group qualified to receive the Matching Familiar Figures pretest. From the group completing the pretest, 57 were classified as impulsive. The reflective kindergarten group consisted of 39 subjects. The method of randomization was used to select 15 reflective kindergarten subjects and 30 impulsive kindergarten subjects. The impulsive subjects were divided into two groups consisting of 15 subjects each. These groups were trained to become more reflective by methods of self-verbalization and delayed responses respectively while performing one-to-one correspondence tasks.

On the second grade level, of the 121 students who qualified in mental ability to take the Matching Familiar Figures Test, a score of 167 was the median response time score. The median error score was 11. The number of second grade students who scored below the median in response time and above the median in errors totaled 83. These subjects were classified as impulsive and were placed randomly in two groups consisting of 15 subjects each. The reflective group totaled 34, but only 15 of them were randomly assigned to this type of group to be used in the study. This group of 15 subjects received the M F F T pretest and posttest as well as the one-to-one correspondence pretest and posttest, but received no training. The procedures in groups selection and training for second grade subjects in the study were identical to those used for the three kindergarten groups.

Comparisons of Groups on the M F F T

Tables 10, 11, and 12 show pretest and posttest scores for each of these groups. In these tables, kindergarten and second grade subjects were combined in the same treatment groups.

Performances by the Delayed Response Group on the M F F T

The delayed response training group in comparison to the self-verbalization training group showed no significant differences in response times on the Matching Familiar Figures pretest and posttest. The scores of the two groups were very near the same on both measures. However, the delayed response training group had a mean gain of 47.6 on the response time measure from pretest to posttest; this was significant at the P = .05 level. Comparably, the self-verbalization training group increased their response time by a mean difference of 57.0, which was significant at the P = .05 level.

Performances by the Reflective Group on the M F F T

In comparing the reflective group mean scores on the Matching Familiar Figures test (M F F T) to the two training groups, Tables 10, 11, and 12 show that the reflective group had a mean response time of 119.7 on the M F F T pretest. This was more than double the mean response time of either of the training groups. Nonetheless, these reflective subjects did not increase their mean response time significantly from pretest to posttest. Even though some subjects did show an increase in response times, the mean scores for all subjects

TABLE 10

Pretest to Posttest Mean Performances by the Delayed Response Training Group on the Matching Familiar Figures Test

Pretest	
Mean Response Time	Mean Errors
54.1	13.4
Posttest	
Mean Response Time	Mean Errors
107.7	4.6

TABLE 11

Pretest to Posttest Mean Performance by the Reflective Group on the Matching Familiar Figures Test

Pretest	
Mean Response Time	Mean Errors
119.7	5.4
Posttest	
Mean Response Time	Mean Errors
119.3	4.0

TABLE 12

Pretest to Posttest Mean Performance by the Self-verbalization Training Group on the Matching Familiar Figures Test

Pretest	
Mean Response Time	Mean Errors
53.9	11.0
Posttest	
Mean Response Time	Mean Errors
110.9	7.2

showed that an increase did not occur for the entire group.

Performances by the Self-Verbalization Group on the M F F T

Comparisons involving the mean error scores for the same three groups showed that the self-verbalization group made an increase of 3.8 in their mean error score. However, the delayed response training group decreased their mean error rate by a mean of 8.8 points and the reflective group only had a mean reduction error rate of .04. Results revealed that of the two training groups, the delayed response group made fewer errors, but did not increase response time significantly longer than did the other group.

Comparisons of the Kindergarten Trained Groups on the M F F T

The kindergarten subjects in both the delayed response and the self-verbalization groups made the greatest increases in response times and the greatest decreases in errors as was mentioned in Chapter V. A further look at the comparisons by the respective groups on the Matching Familiar Figures measure from pretest to posttest is shown in Table 10. From observations during testing it appeared that the preschool form of the Matching Familiar Figures test was less difficult for kindergarten subjects on their particular grade level than it was for second graders on their grade level (see Appendix A and B). Hence, data show that kindergarten subjects did better than the second grade subjects on this test.

Comparisons of Groups on the One-to-one Correspondence Measure

A comparison of performances by the three groups on the one-to-one correspondence pretest and posttest, as seen in Tables 13, 14, and 15 reveals that in each group, mean response times were increased and mean error scores were reduced.

Performances by the Reflective Group on the One-to-one Correspondence Measure

The reflective group made less improvement from pretest to posttest on the one-to-one correspondence measure than did either the delayed response treatment group or the self-verbalization treatment group. The reflective group increased its response time by a mean score of 3.6 and reduced its errors on the same measure by a mean of 1.3 as shown in Table 14.

Performances by the Self-Verbalization Group On the One-to-one Correspondence Measure

On the one-to-one correspondence measure, the self-verbalization group made more progress from pretest to posttest than did either of the other two groups. Also, the gains made by this group were slightly better than those made by the other trained group. The self-verbalization group had a mean gain in response time from pretest to posttest of 14.4 and a mean reduction in errors of 2.0 as shown in Table 15.

It may have been that these subjects were more comfortable with this type of training, because during task manipulations they were allowed to talk. This was found to be true in another study involving verbalization while trying to

TABLE 13

Performance by the Delayed Response Treatment Group on the One-to-one Correspondence Pretest and Posttest

Pretest	
Mean Response Time	Mean Errors
28.0	4.3
Posttest	
Mean Response Time	Mean Errors
41.6	2.0

TABLE 14

Performance by the Reflective Group on the One-to-one Correspondence Pretest and Posttest

Pretest	
Mean Response Time	Mean Errors
50.0	2.6
Posttest	
Mean Response Time	Mean Errors
53.6	1.3

TABLE 15

Performance by the Self-verbalization Treatment Group on the One-to-one Correspondence Pretest and Posttest

Pretest	
Mean Response Time	Mean Errors
27.1	4.1
Posttest	
Mean Response Time	Mean Errors
41.5	2.1

inhibit impulsive responding (Meichenbaum & Goodman, 1971).

Performances by the Delayed Response Group on the One-to-one Correspondence Measure

The delayed response training group made gains in their mean response time of 14.4 from pretest to posttest. Its mean score in error reduction was 2.3 as shown in Table 13. The improvement from pretest to posttest by this group was not as high as that of the self-verbalization group, but higher than that of the reflective group as shown in Tables 13, 14, and 15.

Performances by Kindergarten Groups on the M F F T

In comparing the kindergarten trained groups with the groups on the same level that received no training, it was revealed (Table 16) that only one subject in the delayed response trained group scored less on the posttest than on the pretest. This subject had a response time of 41 seconds on the Matching Familiar Figures pretest and a score of 29.5 on the posttest measure of the same test; however, the error score was reduced from 6 on the pretest to 4 on the posttest.

On this same grade level only one subject in the self-verbalization training group scored less on the posttest than on the pretest (Table 17). This subject had a pretest score on the Matching Familiar Figures Test response time measure of 56 and a response time score of 53 on the posttest. On the errors measure, a score of 2 was made on both pretest and posttest.

Comparatively, five subjects in the reflective group had longer response times on the M F F T pretest than on the posttest. One subject had a pretest

TABLE 16

Posttest Performance by Impulsive Kindergarten Subjects in the Delayed Response Training Group on the Matching Familiar Figures Test

Number of Subjects	Number of Subjects
Performed better on Response Time Measure	Performed better on Errors Measure
14	15
Number of Subjects not performing better	
1	0
Total 15	15

TABLE 17

Posttest Performance by Impulsive Kindergarten Subjects in the Self-verbalization Training Group on the Matching Familiar Figures Test

Number of Subjects	Number of Subjects
Performed better on Response Time Measure	Performed better on Errors Measure
14	15
Number of Subjects not performing better	
1	0
Total 15	15

TABLE 18

Posttest Performance by Reflective Kindergarten Subjects in the Nontrained Group on the Matching Familiar Figures Test

	Number of Subjects	Number of Subjects
	Performed better on Response Time Measure	Performed better on Error Measure
	10	15
Number of Subjects not performing better	5	0
Total	15	15

response time of 44 and a posttest response time score of 42. Another subject made 48 on the pretest response time measure and 51 on the posttest. Another subject in this same category showed a decline of 9 seconds in response time from pretest to posttest making an initial score of 49 and a final score of 40. The difference between pretest and posttest scores for another subject in this group was 9 seconds; this subject had a response time of 48 seconds before training and a score of 39 after training. It was believed that if subjects in the reflective group had been trained in the same manner as subjects in the self-verbalization and delayed response groups, they would have made greater progress from pretest to posttest on the Matching Familiar Figures Test. Table 18 shows the performances of these subjects as discussed above.

It could have been that these reflective kindergarten subjects placed more emphasis on accuracy than on response latency as found in another investigation (Eska & Black, 1971).

Comparisons of Performances by Groups on the Second Grade Level

Considering the training groups and the reflective group on the second grade level, it can be seen from Tables 19, 20, and 21 that all subjects in both training groups did better on the posttest than on the pretest. These findings corroborate findings of previous investigations (Debus, 1970; Eska & Black, 1971). This holds true for the response time measure as well as the errors measure of the Matching Familiar Figures Test. However, on this grade level, one subject in the reflective group had a higher response time on the M F F T pretest than on

TABLE 19

Posttest Performance by Impulsive Second Grade Subjects in the Delayed Response Training Group on the Matching Familiar Figures Test

Number of Subjects	Performed better on Response Time Measure	Number of Subjects	Performed better on Errors Measure
	15		15
Number of Subjects not performing better	0		0
Total	15		15

TABLE 20

Posttest Performance by Impulsive Second Grade Subjects in the Self-verbalization Training Group on the Matching Familiar Figures Test

Number of Subjects	Performed better on Response Time Measure	Number of Subjects	Performed better on Errors Measure
	15		15
Number of Subjects not performing better	0		—
Total	15		15

TABLE 21

Posttest Performance by Reflective Second Grade Subjects in the Nontrained Group on the Matching Familiar Figures Test

Number of Subjects	Number of Subjects
Performed better on Response Time Measure	Performed better on Errors Measure
14	15
Number of Subjects not performing better	
1	0
Total 15	15

the posttest. This difference was only slight, with the subject scoring 204 on the response time measure on the pretest and scoring 201 on the same measure of the posttest. On the errors measure the subject followed the group pattern by moving from a score of 8 on the pretest to 6 on the posttest. All subjects performed better on the posttest of the one-to-one correspondence measure than they did on the pretest of the same measure.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

An experimental investigation was conducted to study the effects of training impulsive kindergarten and impulsive second grade subjects to become more reflective. The Matching Familiar Figures Test was used to measure reflection-impulsivity. Subjects offering rapid inaccurate responses on the Matching Familiar Figures (M F F T) were considered to be impulsive. On the other hand, those subjects with long response latencies and few errors were considered to be reflective.

Adults who work with children need to become aware of the impulsive cognitive tempo and methods that can be used to help to modify the tempo. Educators responsible for designing school curricula in the primary grades need to include in the instructional program, techniques necessary for altering impulsive responding by children when situations of uncertainty exists.

The review of literature indicated that providing training for impulsive subjects to inhibit rapid responses resulting in increasing response latencies and reducing errors contributed to reflectivity. Since mathematics was the subject area of most concern to researchers, it was believed that one-to-one correspondence tasks would provide effective manipulative materials for training subjects during individual sessions.

Impulsive kindergarten and second grade subjects were trained to become more reflective by delayed response techniques and self-verbalization techniques while performing one-to-one correspondence tasks. Both training methods were equally effective in altering their impulsive conceptual tempos and helping them to become more reflective.

Hypotheses

The following hypotheses were tested in this study.

H_1 There are no significant differences among the Matching Familiar Figures Test posttest means of response times for the self-verbalization, delayed response, and reflective groups.

H_2 There are no significant differences among the Matching Familiar Figures posttest means of numbers of errors for the self-verbalization, delayed response, and reflective groups.

H_3 There are no significant differences between the posttest means of the kindergarten and the second grade groups regarding response times on the Matching Familiar Figures Test.

H_4 There are no significant differences between the posttest means of the kindergarten and the second grade groups regarding the number of errors on the Matching Familiar Figures Test.

H_5 There are no significant differences among the posttest means of response times on the one-to-one correspondence test for the delayed response, self-verbalization, and reflective groups.

H_6 There are no significant differences among the posttest means of numbers of errors on the one-to-one correspondence test for the delayed response, self-verbalization, and reflective groups.

H_7 There are no significant differences between the posttest means of the kindergarten and second grade groups regarding the response times measure of the one-to-one correspondence test.

Further post hoc comparisons were made as a result of the findings of these major hypotheses. Of the seven major hypotheses tested, three ($H_{1, 5, 6}$) were significant at $P = .05$, four were not significant at this level.

Subjects

The subjects in the study included all the kindergarten and second grade students attending Allenbrook Elementary School in Charlotte, North Carolina. This involved 125 kindergarten subjects and 135 second grade subjects. Two impulsive groups and one reflective group on the kindergarten and second grade levels respectively were established. Impulsive subjects were randomly assigned to either the self-verbalization training group or the delayed response training group. The reflective group was not trained. Training involved four 15-minute individual sessions including the use of one-to-one correspondence materials. The establishment of groups and training of subjects on the kindergarten and second grade levels were the same.

The experimental design was a 2 x 3 x 2 factorial analysis of variance design with post hoc comparisons using the Scheffé statistical analysis design. This design was computed from scores on the Matching Familiar Figures and the

Matching Familiar Figures and the one-to-one correspondence pretest and posttest.

An analysis of the results indicated that reflectivity training in one-to-one correspondence procedures was effective. Results indicated that both of the training methods used were effective in altering impulsive responding for both the kindergarten and the second grade groups. Kindergarten subjects appeared to have benefited more from the effects of the training than did second grade subjects. The former group had greater mean scores from pretest to posttest on the M F F T response time measure and fewer mean errors on the errors measure.

It was revealed that the conceptual tempo of impulsivity was reduced by training in either self-verbalization or delayed response techniques. These findings were in conjunction with the previous findings in similar studies (Briggs, 1968; Debus, 1970; Kagan, 1965a; Meichenbaum & Goodman; 1971; Ridberg, Parke & Hetherington, 1971) that impulsive tempos in young children can be modified through training procedures. This training results in increased latencies of responses and a reduction of errors.

Results

This study revealed that impulsive subjects who were trained by the technique of self-verbalization and those who were trained by the technique of delayed responses had similar mean scores on both the M F F T pretest and posttest. One trained group did not perform significantly better than the other on either measure.

Some investigators have reported some success in modifying latencies of responses, but have been unsuccessful in significantly altering error scores (Briggs & Weinberg, 1973; Yando & Kagan, 1968). Their findings were not supported in this study.

There was no evidence to suggest that I Q was an important factor in performances by subjects involved, since this variable was not measured. However, other studies (Kagan, 1965a; Ridberg, Parke & Hetherington, 1971) suggested that high I Q subjects had longer latencies and fewer errors than low I Q subjects.

On the one-to-one correspondence measure there were no differences in performances by the groups that were trained to become more reflective by the self-verbalization method as compared to the delayed response method. Both training methods appeared to have produced equal results.

Conclusions

From results of this study, it was concluded that the impulsive cognitive style did not appear to be a fixed unchangeable aspect of behavior, but could be modified by training in reflectivity. It did appear that self-verbalization training helped impulsive children to control to a greater degree their verbal behavior. This method of training allowed impulsive children to place emphasis on attentional strategies, thereby helping to facilitate behavioral changes. The delayed response training forced subjects to take a sufficient amount of time to analyze task requests before offering a response. It was hoped that they would continue to exercise this hesitant behavior, allowing details to be analyzed before

offering a solution to problems of uncertainty.

Children in the primary grades frequently offer answers to math-problems impulsively. Since mastering one-to-one correspondence tasks is basic to understanding other mathematical concepts, implementing training techniques for modifying the impulsive tempo would be beneficial to students in the primary grades.

The results of the study reveal that training impulsive subjects to become more reflective would provide successful experiences for students as they learn to inhibit rapid inaccurate responses. This would allow students to achieve more success in school while participating in large and small group learning situations as problems of uncertainty arise in mathematics as well as in other subject areas.

Recommendations for Further Research

Based upon the procedures, findings, and conclusions of the study the following recommendations for further research are suggested.

1. The effects of training impulsive subjects to become more reflective could be investigated to determine whether the training had a permanent or a temporary effect.

2. An investigation comparing performance by subjects on each training task would allow the investigator to determine the effectiveness of particular sets of manipulative one-to-one correspondence materials.

3. An investigation could be conducted to determine if the sex of particular subjects might have any effect upon training in reflectivity. It would be interesting to assess if both boys and girls derive equal benefits from the reflectivity training.

4. A study of the effects of the behavior of the experimenter upon subjects' performance could give some insight as to whether the personality of one experimenter would have advantages over that of another.

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APPENDIX A

MATCHING FAMILIAR FIGURES TEST

PRESCHOOL SET

DIRECTIONS FOR MATCHING FAMILIAR FIGURES

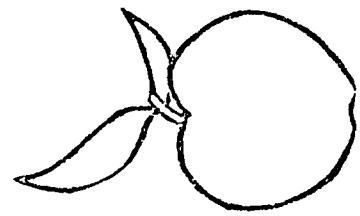
Preschool Set

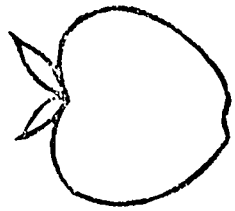
"I am going to show you a picture of something you know and then some pictures that look like it. You will have to point to the picture on this bottom page (point) that is just like the one on this top page (point). Let's do some for practice." E shows practice items and helps the child to find the correct answer. "Now we are going to do some that are a little bit harder. You will see a picture on top and four pictures on the bottom. Find the one that is just like the one on top and point to it."

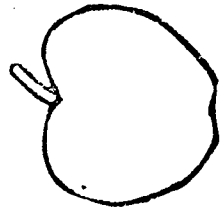
E will record latency to the first response to the half-second, total number of errors for each item and the order in which the errors are made. If S is correct, E will praise. If wrong E will say, "No, that is not the right one. Find the one that is just like this one (point)." Continue to code responses (not times) until child makes a maximum of four errors or gets the item correct. If incorrect E will show the right answer.

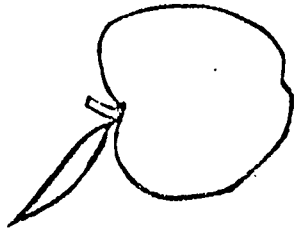
The test should be set up in a notebook. It is necessary to have a stand to place the book on so that both the stimulus and the alternatives are clearly visible to the S at the same time. The two pages should be practically at right angles to one another.

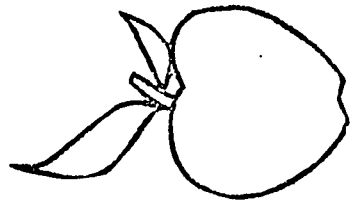
Note: It is desirable to insert the pages in clear plastic which helps to keep the pages clean.

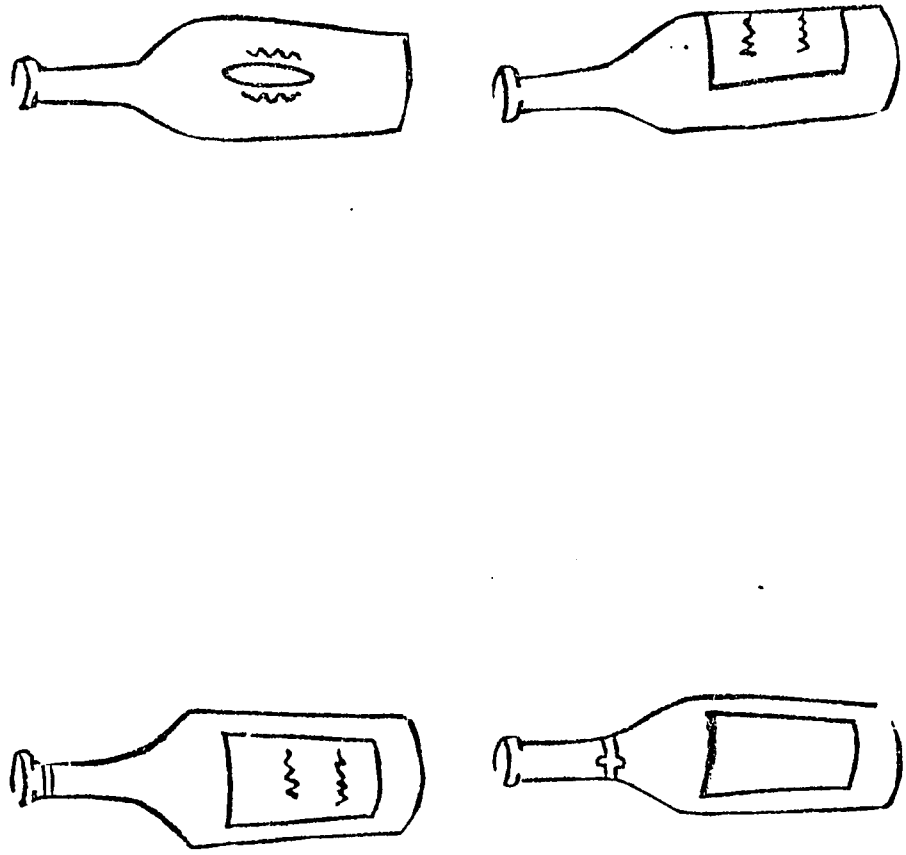












APPENDIX B

MATCHING FAMILIAR FIGURES TEST

PRIMARY GRADE SET

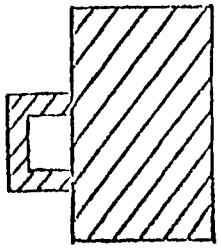
DIRECTIONS FOR MATCHING FAMILIAR FIGURES

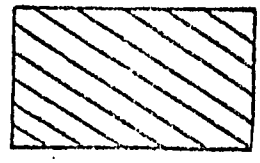
Primary Grade Set

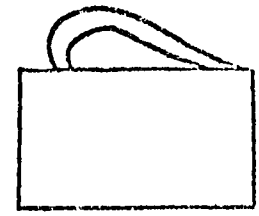
"I am going to show you a picture of something you know and then some pictures that look like it. You will have to point to the picture on this bottom page (point) that is just like the one on this top page (point). Let's do some for practice." E shows practice items and helps the child to find the correct answer. "Now we are going to do some that are a little bit harder. You will see a picture on top and six pictures on the bottom. Find the one that is just like the one on top and point to it."

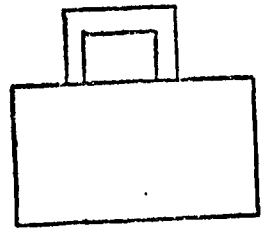
E will record latency to first response to the half-second, total number of errors for each item and the order in which the errors are made. If S is correct, E will praise. If wrong, E will say, "No, that is not the right one. Find the one that is just like this one (point)." Continue to code responses (not times) until child makes a maximum of six errors or gets the item correct. If incorrect, E will show the right answer.

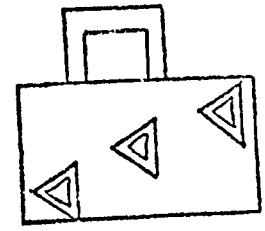
It is necessary to have a stand to place the test booklet on so that both the stimulus and the alternatives are clearly visible to the S at the same time. The two pages should be practically at right angles to one another. Note: It is desirable to enclose each page in clear plastic in order to keep the pages clean.

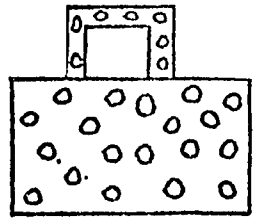


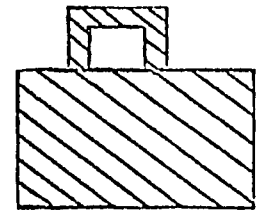


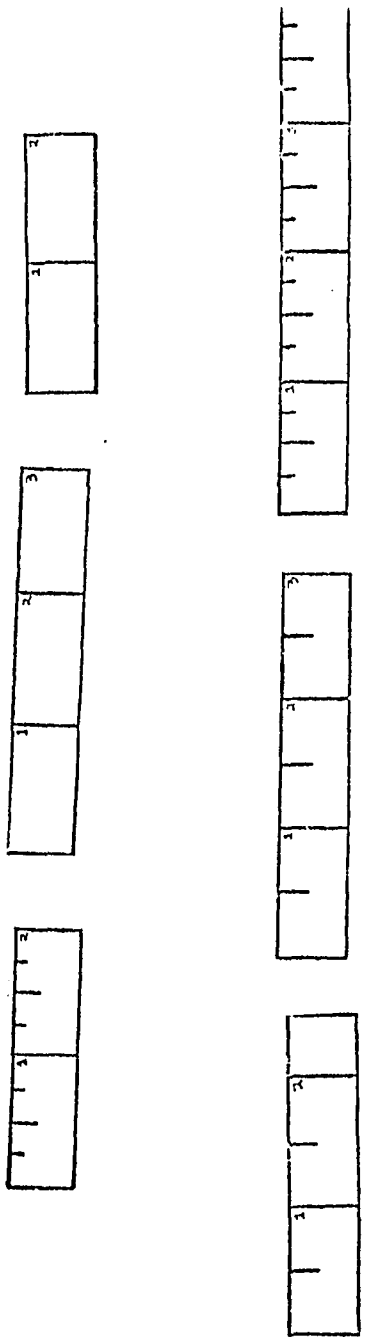


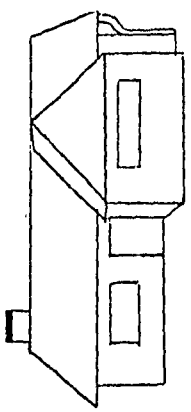


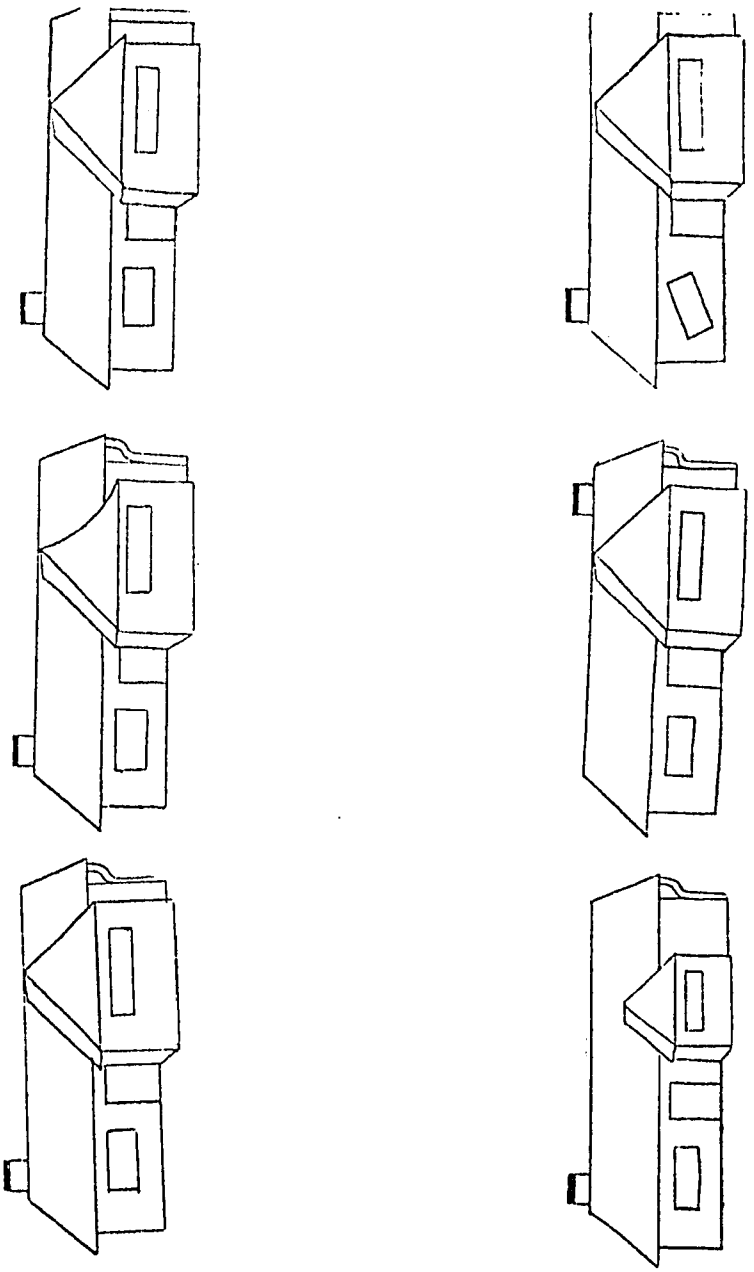












APPENDIX C

ONE-TO-ONE CORRESPONDENCE PRETEST

ONE-TO-ONE CORRESPONDENCE PRETEST

Student's Name_____ Grade_____

Date_____ Teacher_____

Number Wrong___

Materials

8 horses

8 pennies

Procedures: Say, Hello! (Child's Name) How are you today? (Wait for a response.) We are going to play store, just today just the two of us. I am going to be the storekeeper while you are the customer. The only items that are for sale today are toy horses. Let's put the horses in a straight line on the top of the counter. (Arrange all 8 of the horses on top of the counter.) Now, tell me how many horses are there. (Wait for the subject to respond, if he answers incorrectly allow for an opportunity to give a correct response, if this is not achieved, tell him the answer.) Say to the subject, each time that you give me a penny I am going to give you a horse. Now here are some pennies for you. I want you to line them up in a straight row so that you will know how many you have. (Now that horses are lined up in a straight row and pennies are lined up in a straight row the subject can be asked the question.)

____ ____ 1. Question: Are there more horses, pennies, or are there the same amount of both?

Answer: There are the same amount of both.

(Add one penny to the row of pennies.)

2. Question: Are there more horses, more pennies, or are there the same amount of both?

   Answer: There are more pennies.

   (Remove one penny from the row and lengthen the line so that it is no longer equivalent in length to the row of horses.)

3. Question: Are there more horses, more pennies, or are there the same amount of both?

   Answer: There are the same amount of both.

   (Add another horse to the row.)

4. Question: Are there more horses, more pennies, or are there the same amount of both?

   Answer: There are more horses.

   (Add another horse to the row.)

5. Question: Are there more horses, more pennies, or are there the same amount of both?

   Answer: There are more horses.

APPENDIX D

ONE-TO-ONE CORRESPONDENCE TRAINING TASK

ONE-TO-ONE CORRESPONDENCE TRAINING TASK

Training Task #1

Student's Name_____ Grade_____

Date_____ Teacher_____

Number Wrong_____

Response time will be recorded in the first blank beside the numeral. A + will be recorded in the second blank indicating a correct response while a - will be recorded to indicate an incorrect response.

In this training session, the materials that will be used will consist of counting bears. As the session begins, the Examiner will place five blue counting bears in a straight row and request that the subject follow the same procedure by selecting five red bears from the box that is placed on the table. The box contains 100 red and blue bears. (After the bears are placed in two straight rows the examiner will ask the first question.)

_____ _____ 1. Who has more bears, you or I, or do we both have the same number of bears?

Answer: We both have the same number of bears.

(Rows will be transformed by expansion. The subject will be requested to add one bear to his row.)

_____ _____ 2. Who has more bears you or I, or do we both have the same number of bears?

Answer: I have more bears.

(An additional bear will be added to the examiner's row.)

____ ____ 3. Question: Who has more bears, you or I, or do we both have the same number of bears?

Answer: We both have the same number of bears.

(One bear will be removed from the subject's row.)

____ ____ 4. Question: Who has more bears, you or I, or do we both have the same number of bears?

Answer: You have more bears.

(Another bear will be removed from the examiner's row.)

____ ____ 5. Question: Who has more bears, you or I, or do we both have the same number of bears?

Answer: The examiner has more bears.

When the first question is asked, both rows will be six inches apart so that the subject can clearly see that for one object in a set there is a corresponding object in another set. However, when the second question is asked, the distance will be increased to 12 inches between corresponding rows. When the third question is asked, one set of objects will be slightly bunched together while the other remains in a straight row. Oscillation between adding and subtracting objects in corresponding rows will be performed until the subject assesses the quality of the rows. If a subject responds incorrectly to a question, the procedures of lengthening or shortening the rows will be rearranged so that the subject can clearly see the examiner as he removes or adds an object.

Training Task #2

Student_____ Grade_____

Teacher_____ Grade_____

Number Wrong_____

Materials:

8 jars (3x4)

8 jar lids (3 inches in diameter)

Response time will be recorded in the first blank to the left of the numeral. A (+) will be recorded in the second blank to indicate a correct response on the first trial. A (−) will be recorded in the second blank if the subject answered incorrectly on his first trial.

Greet the student by saying, "Hello _____" (The student's name will be on a name tag that he wears.) Wait for a response, then say, "We are going to play a game today with jars and jar lids."

(Place seven jar lids in a straight row, request that the subject place six jars in a corresponding row. There should be approximately six inches between rows.)

_____ _____ 1. Question: Which are there more of, jars, jar lids, or is there the same number of both?

Answer: There are more jar lids.

(Request that the subject add one jar to the row of jars bunching them together.

____ ____ 2. Question: Which are there more of, jars, jar lids, or is there the same number of both?

(Add one jar lid to the row. Arrange rows so that there are approximately twelve inches between rows.)

____ ____ 3. Question: Which are there more of, jars, jar lids, or is there the same number of both?

(Request that the subject add an additional jar to the row of jars.) Rows should be straight, but still twelve inches apart.

____ ____ 4. Question: Are there more jars, jar lids, or is there the same number of both?

(Remove, one jar lid from the row.)

____ ____ 5. Question: Which are there more of, jars, jar lids, or is there the same number of both?

Answer: There are more jars.

Training Task #3

Student_____ Date_____

Teacher_____ Grade_____

Number Wrong_____

Materials:

8 dolls (6 inches tall)

8 doll shoes (These shoes will fit the dolls used.)

Response time will be recorded in the first blank to the left of the numeral. A (+) sign will be recorded in the second blank to the left of the numeral to indicate a correct response by the subject on his first trial. A (-) sign will be recorded in the second blank to the left of the numeral if the subject answered the question incorrectly on his first trial.

Greet the student by saying "Hello_____." (The student's name will be on a name tag that he wears.) Wait for a response, then say, "We are going to play a game today with dolls and doll shoes." (Place 7 dolls in a straight row and ask the student to place 6 doll shoes in a row. Be sure that the rows are six inches apart.)

_____ _____ 1. Question: Which are there more of, shoes, dolls, or is there the same number of both?

(Rows will be transformed by expansion. The subject will be requested to add one shoe to his row as the examiner bunches the dolls closer together.)

____ ____ 2. Question: Which are there more of, dolls, doll shoes, or is there the same number of both?

Answer: There is the same number of both.

(An additional doll will be added to the examiner's row.)

____ ____ 3. Question: Which are there more of dolls, shoes, or is there the same number of both?

Answer: There are more dolls.

(The subject will be requested to add one shoe to his row. The examiner will now be sure that both rows are straight and approximately 12 inches apart.)

____ ____ 4. Question: Which are there more of, dolls, shoes, or is there the same number of both?

Answer: There are more shoes.

(The examiner will add one doll to the row of dolls.)

____ ____ 5. Question: Which are there more of, dolls, shoes, or is there the same number of both?

Answer: There is the same number of both.

Training Task #4

Student_____ Date_____

Teacher_____ Grade_____

Number Wrong_____

Materials:

8 pencils (6 inches long)

8 pencil erasers (1/2-inch long and 1/4-inch in diameter)

Response time will be recorded in the first blank to the left of the numeral. A (+) sign will be recorded in the second blank to the left of the numeral to indicate a correct response, made by the subject on his first trial. A (-) sign will be recorded in the second blank to the left of the numeral, if the subject answered the question incorrectly on his first trial.

Greet the student by saying, "Hello_____." (The student's name will be on a name tag that he wears.) Wait for a response, then say, "We are going to play a game today with pencils and erasers." (Place 7 pencils in a straight row and ask the student to place 6 erasers in a corresponding row. Be sure that the rows are six inches apart.)

_____ _____ 1. Question: Which are there more of, pencils, erasers, or is there the same number of both?

Answer: There are more erasers.

(Add one pencil to the row of pencils, this time bunching pencils closer together.)

2. Which are there more of, pencils, erasers, or is there the same number of both?

   Answer: There is the same number of both.

   (Request that the subject remove one eraser from the row of erasers. Be sure that the space between rows are now approximately 12 inches and the rows are straight, but not equal distance in length.)

3. Question: Which are there more of, pencils, erasers, or is there the same number of both?

   Answer: There are more pencils.

   (Remove one pencil from the row of pencils with rows still approximately the same as they were before the previous question was asked.)

4. Question: Which are there more of, pencils, erasers, or is there there the same number of both?

   Answer: There is the same number of both.

   (Request that the student remove one eraser from the row of erasers. Be sure that the rows are approximately 12 inches apart, and straight, but not the same length.)

5. Question: Which are there more of, pencils, erasers, or is there the same number of both?

   Answer: There are more pencils.

APPENDIX E

ONE-TO-ONE CORRESPONDENCE POSTTEST

ONE-TO-ONE CORRESPONDENCE POSTTEST

(Give the subject five flowers and ask that they be arranged in a straight row. At the same time arrange five vases in a row approximately six inches away from the flowers.)

____ 1. Question: Which are there more of, vases, flowers, or is there the same number of both?

Answer: There is the same number of both.

(Add one flower to the subject's row, bunch vases closer together moving the sets about fifteen inches apart.)

____ 2. Question: Which are there more of, vases, flowers, or is there the same number of both?

Answer: There are more flowers.

(Add one vase to the row, this time keeping them in a straight row with approximately fifteen inches between each set.)

____ 3. Question: Which are there more of, vases, flowers, or is there the same number of both?

Answer: There is the same number of both.

(Add another vase to the row of vases.)

____ 4. Question: Which are there more of, vases, flowers, or is there the same number of both?

Answer: There are more vases.

(Take away one vase, but keep both sets in a straight row.)

____ 5. Question: Which are there more of, vases, flowers, or is there the same number of both?

Answer: There is the same number of both.