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THE EFFECT OF TEACHERS' COGNITIVE TEMPO ON CHILDREN

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

Regina Marie Yando, B.S., M.A.

* * * * * *

The Ohio State University
1966

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Adviser
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VITA

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CHAPTER I

INTRODUCTION AND REVIEW OF THE LITERATURE

Introduction

Attention has been given recently to the amount of time used in problem solving. Specifically, consideration has been given to the amount of time an individual requires before making a decision as to the validity of a tentative solution in a problem-solving situation. The reflection-impulsivity dimension, as proposed by Kagan (1965a), describes the consistent tendency on the part of a person to display slow or fast response time in problem-solving situations which involve high response uncertainty (i.e., selection of one hypothesis from among many possibilities). The present investigation is concerned with the influence of teachers on the development of the reflection-impulsivity dimension in children.

One of the basic goals of educational institutions is to develop the problem-solving capacity of the child. The manner in which the goals are attained and the success of the methods used, however, are not clearly defined. This may be caused in part by the varied and often murky explanations of the problem-solving process. Therefore, it becomes the responsibility of the educator and other related behavioral scientists to work toward a better understanding and explanation of problem-solving behavior.
Problem-solving behavior has been used by many investigators to study underlying variables in the cognitive processes (Van De Geer and Jaspers, 1966). Duncan (1959), in a review of the literature on problem solving, indicates that most of the empirical studies in the area are concerned with independent variables that influence problem solving performance. These variables appear to fall into one of the following classes:

**Situational variables.** Typical studies compare the problem solving behavior of groups in contrast to individual problem-solving activity (Taylor and Faust, 1952; Marks, 1951).

**Motivational variables.** Representative studies have investigated the effect of social attitude on problem-solving performance (Levitt, 1956). Some investigators have related scores on the Taylor Anxiety Scale (Staats, 1957) or McClelland's achievement test to performance on problem-solving tasks (Rhine, 1956).

**Task or procedural variables.** Most of the studies investigating the effect of procedural variables have introduced independent variables during work on the test problem; have changed the problem itself; or, have trained subjects in a situation and assessed performance using a transfer design (Saugstad, 1957; Cobb and Brenneise, 1952; Hilgard, Irvine and Whipple, 1953).

**Individual differences or subject variables.** Typical studies have compared the performance of children of high or low mental ability (Corman, 1957) or of good and poor problem-solving ability (Fattu, Mach and Kapos, 1954).
The concern of the present investigation is with the latter variable; that is, individual differences in problem-solving behavior. Some individuals solve problems quickly and correctly while others take more time. To explain the accuracy and speed of problem solving, the most common variables referred to are adequacy of conceptual skills and the effective use of these skills (Kagan, in press).

Kagan (1966b) has taken a unique approach to explain variability in the speed and accuracy of problem solving. He states that the first phase of problem solving is information processing. Since many problem-solving situations appear to contain elements of stimulus and response uncertainty, a decision time factor is introduced. If the problem-solving situation is such that many solution hypotheses are simultaneously available to the subject, decision time should be increased as a result of the processing and categorizing of stimulus information and evaluation of alternative solution hypotheses. Kagan, then, recognizes decision time as an important variable in problem solving activity. He states that individuals seem to have "... a clear preference hierarchy with respect to the stimulus characteristics to which they initially attend and the speed with which classification decisions are made." (Kagan et al., 1964, p. 1)

The importance given to the time variable in problem solving by Kagan can be further justified on the basis of Underwood's (1952) distinction between problem solving and conditioning or rote learning. According to Underwood, conditioning and rote learning are presumed to involve relatively little discovery; whereas problem solving is
considered to be highly related to the discovery of the correct response. Therefore, if problem solving requires response selections out of many possible combinations, some individuals, because of different methods employed for selection and evaluation of the potential response, may take more time to determine their response than others. Hence, it would seem important to investigate the influence of time per se as a factor in the explanation of individual differences in problem solving. With the exception of Kagan's investigations, most research in the area of cognitive processes typically has been indifferent to the role of time as a variable within the problem-solving sequence.

Kagan's postulation of a reflection-impulsivity dimension uses decision time to explain individual differences in the quality of problem solving. He describes the cognitive phenomena involved in the beginning and end of a problem-solving sequence as "...the initial coding of information, the selection of a 'best' solution hypothesis, and the psychological characteristics of the response the child uses to communicate his answers to a social agent," (Kagan et al., 1964, p. 35)

**Statement of the problem**

If the reflection-impulsivity dimension is closely associated with problem-solving behavior (as suggested by Kagan) it becomes very important to determine the various parameters of the dimension. For example, it is necessary to determine how a child becomes reflective or impulsive and to investigate whether children can be influenced toward reflectivity or impulsivity by placing them in a situation
where there is ample opportunity to imitate either reflective or
impulsive behavior and to be reinforced for their imitation.

Elementary school provides an excellent natural setting for
such a study. Because of different home environments, some children
may learn to be reflective, while others may have become impulsive.
In the classroom situation, it can be assumed that some teachers will
be found to be impulsive; others, reflective. Hence, at least in a
very subtle manner, teachers are likely to reinforce behavior similar
to their own. Therefore, if one could categorize teachers as reflec-
tive and impulsive and could assign similarly classified or unclas-
sified first grade children to these teachers, a test after a period
of one school year in such a classroom situation would provide evidence
on the modifiability of the children's reflection-impulsivity dimension
resulting from the influence of an educational setting.

The present study was designed to investigate the modifiability
of the reflection-impulsivity dimension in a school setting.

Questions to be considered and
specific hypotheses

The purpose of the present investigation was to study the gen-
eral characteristics of the reflection-impulsivity dimension.
Specifically, the following questions were considered:

1. Do the data support the previous research concerning the
reflection-impulsivity dimension? In particular, is Kagan's postu-
lation of a significant negative correlation between response time
and perceptual recognition supported by the data?
2. What is the relationship between teacher age, teaching experience, and teachers' reflective-impulsive disposition?

3. What is the relationship between children's socioeconomic rating and the reflection-impulsivity dimension?

4. What is the relationship between children's reading performance and the reflection-impulsivity dimension?

Further specific hypotheses to be considered were as follows:

1. **Modifiability of the reflection-impulsivity dimension.** Is it possible to make a child more reflective or impulsive by placing the child with teachers of a specific reflective or impulsive disposition? If experiential factors play any role in the development of this disposition, impulsive and reflective teachers should have a differential effect on the impulsive-reflective dispositions of children. More specifically it was hypothesized that—

   (a) With an impulsive teacher, a test of reflection-impulsivity will demonstrate a change in children's dispositions toward impulsivity.

   (b) With a reflective teacher, a test of reflection-impulsivity will demonstrate a change in children's dispositions toward reflection.

2. **Model similarity and modifiability of the reflection-impulsivity dimension.** If a child is impulsive and has an impulsive teacher, he may identify more with the teacher because of cognitive similarity than a child who is not impulsive and is working with an impulsive teacher. Also, if a child is reflective and has a
reflective teacher, he may identify more with the teacher because of cognitive similarity than a child who is not reflective and is working with a reflective teacher. As stated, the child may identify with the teacher more readily because of the possibility of a perceived similarity in cognitive modes. The identification, then, may cause greater change in the child. Although there is some evidence that the model plays an important role in modifiability (Kagan, 1966a), a lack of relevant information concerning the variables related to model identification makes it impossible to hypothesize any direction. For this reason the following hypothesis was presented:

The reflective-impulsive disposition of a child will be modified if there exists a similarity or dissimilarity between the cognitive tempo of the child and of the model (teacher).

(a) If the teacher is reflective and the child is reflective, the cognitive tempo of the child will be modified.

(b) If the teacher is impulsive and the child is reflective, the cognitive tempo of the child will be modified.

(c) If the teacher is reflective and the child is impulsive, the cognitive tempo of the child will be modified.

(d) If the teacher is impulsive and the child is impulsive, the cognitive tempo of the child will be modified.
Assumptions

For the purposes of the present investigation it was assumed that--

1. Teachers and children could be identified and classified as reflective or impulsive. This assumption is contingent upon the existence of a significant negative correlation between response time and perceptual recognition error scores.

2. The reflection-impulsivity dimension is a fundamental cognitive disposition which affects the information-processing phase and subsequently the end product of the problem-solving process in situations of high response uncertainty.

3. A child desires to maximize his similarity to a desirable adult and consequently identifies with this model. It is further assumed that the teacher, in most cases, fulfills the role of a model.

Definition of terms

Before reviewing the literature, it will be necessary to define several terms that are unique to these studies.

**Reflection-impulsivity dimension.** The term describing the consistent tendency on the part of a person to display slow or fast response times in problem situations with high response uncertainty. The operational index of this variable is response latency in such visual discrimination tasks as the Matching Familiar Figures Test (MFF). In short, it can be considered a decision time variable.

**Reflective.** The term denoting a person who has the tendency to reflect upon the quality of a cognitive product. Operationally,
scores on such tasks as the MFF are high response time coupled with low error scores.

**Impulsive.** The term descriptive of the person who is prone to initiate the problem-solving process with the first hypothesis that occurs to him and gives insufficient reflection to the possible validity of his answers. Operationally, scores on such tasks as the MFF are low response times coupled with high error scores.

**Conceptual tempo.** The connotative meaning assigned to the reflection-impulsivity dimension.

**Analytic concept.** A concept based upon a shared similarity in a particular objective component among a set of stimuli (e.g., people with coats on, animals with long ears); as differentiated from such global concepts as "poverty-stricken people."

**Conceptual Style Test (CST).** A set of thirty cards, each composed of black and white drawings of familiar objects, used to measure analytic conceptualizations. Subject is asked to choose two of the three pictures that are alike or go together in some way and to state the basis for his grouping.

**Matching Familiar Figures Test (MFF).** The subject is shown a picture (standard) and six to twelve highly similar stimuli, only one of which is identical to the standard. The subject is asked to select the one stimulus identical to the standard. Both the standard and variations are available during selection by the subject. Scored variables are number of errors and average response time to the first selection (A test item, given as an example can be found in Appendix A, page 62).
Haptic Visual Matching Test (HVM). The subject has no visual access to a wooden form (approximately three inches square) which he is given to explore with his fingers (unlimited time). When the subject withdraws his hands, he is presented with a visual array of five stimuli, one of which represents the form previously presented. Selection of the visual stimulus that corresponds to the form explored haptically is requested. Scored variables are errors, response time, and palpation time.

Design Recall Test (DRT). The subject is presented a simple design for five seconds. Standard is removed, and fifteen seconds later an array of eight to ten similar stimuli is presented. Selection of the identical stimulus to the standard is sought. Scored variables are errors and average response time.

Hidden Figures Test (HFT). The test consists of one practice and eleven test items, each of which includes a figure card that illustrates a familiar object (e.g., plane, horse) and a hidden figure card in which the object is embedded.

Review of the Literature

Generality of the reflection-impulsivity dimension. In general, the first set of studies (Kagan et al., 1964) indicated that the reflection-impulsivity dimension is a fundamental cognitive disposition which demonstrates intraindividual stability and intertask generality. The disposition was found to contribute considerable variance to the production of such complex cognitive products as analytic concepts (CST) and recognition errors on such perceptual
discrimination tasks as the DRT and MFF. Briefly, these studies (Kagan et al., 1964) were conducted in the following manner.

Sixty-two boys in grades one and two were administered the CST, HFT, selected WISC subtests, and the modified Rorschach test. An assessment of the relationship between the child's approach to the CST and his performance on the three additional tests was made. The results indicated that the tendency to reflect over alternative response possibilities was positively related to the production of analytic concepts.

Next, a group of second grade boys and girls (ninety each) was assigned to one of two experimental groups and administered the CST, HFT, and DRT. One group was instructed to respond quickly; the other group was instructed to delay response and reflect over their answers. The expectation was that a set to reflect would increase the production of analytic concepts. It was found that children who were instructed to delay response produced more analytic concepts and made fewer perceptual recognition errors on the DRT.

Stability of the dimension. A third study, in which seventy-five boys and sixty-three girls (grades two and three) were administered the CST, DRT, and several related tests, supported previous findings and indicated a high consistency of recognition errors and response time scores across two administrations of the DRT separated by a period of nine weeks. These students were then administered a new test (MFF) of reflection-impulsivity one year later. Again, the scores were correlated with the earlier measures of reflection
impulsivity. Significant correlations suggested moderately high stability of the dimension over a one-year period.

Another study was conducted with third-grade children to assess the effects of impersonal versus reassuring testing conditions on the reflection-impulsivity dimension. It was predicted and supported that experimenter rapport should have a minimal effect on performance on the DRT and MFF.

In sum, the evidence from these studies indicated that reflection over alternative-solution possibilities is a fundamental cognitive disposition which influences both analytic concepts on the CST and perceptual-recognition errors on the DRT and MFF.

Developmental trends. In general, later studies substantiate earlier findings. Analysis of the data (Kagan, 1965a) indicates that the reflection-impulsivity dimension evidences developmental trends. That is, with age, there is a linear increase in analytic concepts on the CST, and an increase in response time and a decrease in errors on the DRT, MFF, and HVM. Also, response time was found to be relatively orthogonal to intelligence test scores.

Related variables. The most recent studies can be grouped as investigations of the reflection-impulsivity dimension in relation to serial learning tasks, reading recognition errors and modifiability. The following studies can be considered most representative of these investigations.

A replication study (Kagan, 1966b) investigating the relationship between impulsivity and errors of commission in a serial
learning task was conducted with third-grade children previously classified as either reflective or impulsive. The children were assigned to one of three groups—a threat group, a reflection group, and a control group. The children were administered two lists of words after which one group was told their performance was poor; a second group was told that the following lists were to be difficult, and the controls were given no special communication. The hypothesis that impulsive children would make more errors of commission in the serial learning procedures was supported. A second hypothesis, that a communication which strongly suggests future failure will effect greater deterioration in serial learning performance for reflective, in contrast to impulsive children, was only minimally supported and found primarily among boys.

Regarding reading ability (Kagan, 1965c), a group of sixty-five boys and sixty-five girls was tested at the end of the first and second grades. Tests administered were the DRT, HVM, MFF, selected WISC verbal subtests, and letter and word-recognition tests. It was predicted that reflective children, in contrast to impulsive children, would be more accurate in reading English words presented singly or in a prose selection. The prediction was supported. The measures of impulsivity found in the first grade were positively related to reading errors one year later, with fast response time being the best predictor for boys, and high error scores the best predictor for girls. It is suggested that "the child's tendency to make fast decisions in problems with response uncertainty is one determinant of quality of reading performance. . . ." (Kagan, 1965c, p. 628).
To enhance the theoretical structure which has begun to develop in the network of studies presented, an important step would be to investigate the antecedents of the reflection-impulsivity dimension and to determine whether or not it can be modified through training or manipulation of other situational variables. Kagan (in press) suggests three (though not mutually exclusive) hypotheses to explain the origin of the reflective-impulsive disposition. These hypotheses are constitutional predisposition, degree of involvement in the task, and the expectation of failure. Though there is no research available specifically investigating the origin of the disposition, the most logical speculation appears to be concerned with the training children receive in the family and in other important social environments. If a child finds members of the family behaving in a reflective or impulsive manner, imitates them and is reinforced for the imitative behavior, the probability is very high that the child will engage in similar imitating behavior in other related situations. If this line of speculation is valid, one should be able to demonstrate that the reflective or impulsive behavior of a child can be modified in any direction by creating an appropriate training situation. Tentative support for this line of argument is indicated in the following study by Kagan.

The most recent study (Kagan, 1966a) concerns the modifiability of an impulsive tendency by training impulsive children to be more reflective. An additional assumption pertaining to identification with a model was considered in the study. "It was assumed
that the initial belief in similarity to the tutor would act as an
incentive to motivate the child to add to the number of shared simi-
larities." Impulsive children were selected out of a group of one
hundred fifty-five first-grade children on the basis of the MFF and
were assigned to one of the three groups: (1) children trained under
conditions of perceived similarity to the trainer; (2) children
trained under low perceived similarity to the trainer; and (3) chil-
dren given no training. Ten boys and ten girls comprised each of the
three groups. In addition, twenty reflective children (ten boys and
ten girls) were selected as a control group and given no training.
All children were matched (as closely as possible) on the basis of
verbal ability (WISC subtests, and inductive reasoning tests). Each
of the children in the training groups was seen by an adult of the
same sex for three independent sessions lasting about forty to fifty
minutes and separated by two to three days. The training groups dif-
fered in that in group I, the trainer attempted to persuade the child
that he and the S shared some common interests and attributes, while
the second group was not treated in any way that would lead the child
to believe he and the trainer shared characteristics. Retesting fol-
lowed six to eight weeks after the first session. Both groups after
training produced longer response times on the MFF in comparison to
the impulsive children not trained. The effect of high identification
to the trainer had a slight advantage for the girls but none for the
boys.
Significance of the present study

Research has shown the reflection-impulsivity dimension to be an important variable in the problem-solving sequence; it appears to affect the manner in which external information is organized and classified, and the form and content of a final response. As such, Kagan (1965a) has reported the importance of the recognition of this disposition in regard to problem solving efficiency and test methodology. Many group and performance type intelligence tests and a variety of projective techniques do not take "decision time" into consideration. As a result, the reflective child may be penalized for what appears to be deficient performance when his approach to problem solving is really the factor being measured. It is evident, then, that the psychologist and the educator should become aware of a child's approach to problem solving in order to obtain accurate diagnosis and accurate appraisal of a child and his school achievement.

The present investigation was designed to understand better the development of the reflection-impulsivity disposition and the effect of specific environmental variables upon it. If it can be shown that a child's reflective-impulsive disposition can be modified by his environment, it becomes extremely important to define the manner in which the modification occurs. Most important, the results of the present investigation should serve to define the responsibility of the educator in regard to the development of the reflection-impulsivity dimension, and ultimately to understand better the problem
solving process. For, if it is possible to modify the reflective-impulsive disposition of a child, the teacher becomes responsible for recognizing his role in the modification of the disposition and its subsequent effects on a child's academic performance. Further, it is quite possible that training programs can be instituted to aid the child in developing specific approaches to a variety of problem-solving situations.

Organization of the Dissertation

Chapter I presents an introduction to the subject of this study and a review of the literature related to it. In addition, the definition of terms, the significance and organization of the study, and the hypotheses to be investigated, are included. In the second chapter the procedures used in the investigation, including population and material description are described. The third chapter contains the statistical analysis, results of the investigation, and a discussion of the findings. The final chapter contains a summary of the information obtained in the investigation and a speculative consideration of the data. Suggestions for further research are presented.
CHAPTER II

PROCEDURES

The present investigation was conducted with the cooperation of the Clark County Board of Education, Springfield, Ohio. The participating six school districts which comprise the county school system are predominantly rural in population. In 1964-65 there were twenty-one elementary schools with a population of 1,268 children. The total first grade teacher population was forty-three (all female). The study was begun prior to the beginning of the 1964-65 school year and completed shortly before the end of the same school year (August 1964 to April 1965).

Design

In general, the present investigation was designed to determine the effect of teachers' cognitive tempo on the reflective-impulsive disposition of children. Initially, however, it was necessary to examine and to analyze the general characteristics of the dimension in order to determine the feasibility of testing for teacher-student interaction.

The following variables were selected to be examined in order to define the general characteristics of the reflection-impulsivity dimension:

Teacher variables, reflective-impulsive disposition, age, and teaching experience.

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Student variables. reflective-impulsive disposition, reading achievement, socioeconomic level, and sex.

Selection of tests

The following tests were selected to classify teachers and/or children in regard to the variables to be investigated.

1. Reflective-impulsive dispositions. Three forms of the Matching Familiar Figures Test (MFF) were used. The adult form, administered to the teachers, consists of twelve items, each containing a standard and eight similar stimuli (Appendix A, page 62). Two versions of the children's MFF were used because of pre and post testing procedures. Both versions (Examples of test items given in Appendixes B and C, pages 63 and 64) consist of ten items, each of which presents one standard and six similar stimuli. They differ in the level of difficulty of the visual arrays.

Two practice items were presented to the subject (either teacher or child) and the following directions were used:

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.

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.

Regarding children only, if the response was correct, the examiner praised the child; if wrong, the examiner said, "No, that is not the right one. Find the one that is just like this one (point)." The critical variables scored were response time to the first answer and
total number of errors across the test.

The MFF was chosen for use in the present study on the recommendation of Dr. Jerome Kagan.

2. Reading achievement. Two tests were used, the Metropolitan 
Reading Readiness Test (MRR) (pre-test) and the Huelsman Word Discrim-
ination Test (HWD) (post-test). The MRR is constructed for children 
from the age of five to eight. It is scored on the basis of the fol-
lowing tests: similarities, copying, vocabulary, sentences, information, 
numbers, and writing the name.

Since the population of children to be tested was so large, it 
was necessary to select a test which was routinely administered to 
beginning first-grade children in the entire school system. Therefore, 
the MRR was selected on the basis of its required administration to 
all pre-schoolers in the Clark County school system.

The HWD is a reading test which indicates how well a student 
uses length, internal design, and external configuration in the per-
ception of words. The test is untimed and yields a grade level 
score from 1.2 to 8.5. The recommendation of Dr. Charles B. Huelsman 
determined the use of the HWD in the present study.

3. Socioeconomic level. An occupational scale reported by 
Leonard Reissman in *Class in American Society* was used to classify 
the children socioeconomically. It is an extended version of the 
North-Hatt scale of occupations. The scale yields a point score 
ranging from thirty-three (shoe-shiner) to ninety-three (surgeon).
The only readily accessible information pertaining to the socio-economic level of the children was the father's occupation. Therefore, it was necessary to select a scale dependent only upon this variable. The only scale that could be found to meet the requirement was the North-Hatt scale.

**Selection of subjects**

The design of the present investigation necessitated the selection of teachers before the selection of children.

1. **Teachers.** In August, 1961, the writer interviewed and administered the MFF (adult-I) to all first-grade teachers (forty three) in the Clark County school system. Each session was approximately forty-five minutes in length. The teachers were told that they and their students were to participate in an educational study, the nature of which could not be disclosed to them at that time. The MFF was administered in the manner described earlier, with the mean response time and the error scores as the variables recorded. With the exception of one teacher (who was subsequently dropped from the study), rapport was satisfactory during testing. On the basis of MFF response time and error scores, fifteen reflective (response time above the mean; errors below the mean) and fifteen impulsive (response time below the mean; errors above the mean) teachers were chosen for inclusion in the study. The remaining twelve teachers excluded from the study could not be classified as either reflective or impulsive on the basis of the operational definition of the dimension. Table 1 indicates the mean response time and errors for teachers.
The final number of teachers included in the study, then, was thirty (fifteen reflective and fifteen impulsive). Teacher age ranged from twenty-two to sixty-three years. Their teaching experience ranged from no experience to thirty-two years.

TABLE 1
MFF Mean Scores for Teachers

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<th></th>
<th>Mean Response time</th>
<th>Mean errors</th>
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<tbody>
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<td>Total Teachers</td>
<td>35</td>
<td>5</td>
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<td>Reflective Teachers</td>
<td>61</td>
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<td>Impulsive Teachers</td>
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</tbody>
</table>

2. Children. From the class lists of children scheduled for the impulsive and reflective teachers, respectively, twelve children, of whom two were alternates (six boys and six girls), were randomly selected for the study. No attempt was made to select specifically classified children. Therefore, it can safely be stated that not all the children in the study would be classified as reflective or impulsive. That is, although all children were administered the children's versions of the MFF and subsequently classified according to response time and error scores, this was not a determining factor in the selection of children. All 360 children participating in the study had no previous school history, and were between the ages of six and seven.
Pre-testing

Prior to and during the first week of school (September, 1964), the writer administered the MFF (children's version I) to the 360 children selected for the study. The MFF testing sessions were approximately one-half hour in length for each child and the instructions described earlier were used (page 19). Response time to the first selection of each item and number of errors were recorded. Scoring of the data and classification of the children (reflective—response time above mean, error score below; impulsive—response time below mean, error score above) was not completed until June of 1965, eliminating knowledge of the results as an influencing factor on the examiner in the post-test situation. During September, the guidance personnel administered the MRR.

Post-testing

The post-testing sessions began in the latter part of March, 1965, and extended into early April. Upon post-testing, it was found that two of the thirty teachers selected for the study had left the district and subsequently their classes had to be eliminated from the study. Of the 360 children, only 258 had remained in the classes of the twenty-eight respective teachers. The writer administered the MFF (children's version II) to these children. The testing sessions and instructions were identical to the pre-test sessions. The County school psychologists administered the HWD. The writer collected the socioeconomic data from the children's official records in the County office.
Treatment of the Data

Upon completion of the collection of the data, it was found that four of the fifteen reflective teachers were conducting classes for "slow-learners" (IQ's between 50 and 80). Since there had been no previous data concerning the slow-learning child, and no impulsive teachers teaching such classes, it was decided to eliminate these classes and four randomly selected impulsive teacher's classes from the study. Therefore, a total of eight classes were eliminated, and twenty classes (ten taught by reflective and ten by impulsive teachers) were retained for purposes of the study. In each class, at least four children of each sex from the formerly selected six males and six females remained after the above-mentioned attrition. In those classes in which more than four of either sex remained, subjects of each sex in excess of four were randomly eliminated. The treatment of the data, then, was confined to the information obtained on twenty teachers (ten reflective and ten impulsive) and one hundred and sixty children (eighty boys and eighty girls).

The data used for analysis were derived from two sources: teachers and students. There were four variables relating to teachers and eight variables relating to the students. Teacher variables were as follows:

1. Response time--mean response time on MFF
2. Errors--mean error score across all items on the MFF
3. Age
4. Experience--years in teaching

The student variables were:
1. Pre response time—mean response time to the first selection in each item of the MFF
2. Pre errors—mean error score across all items of the MFF
3. Post response time—MFF
4. Post error score—MFF
5. Metropolitan Reading Readiness Score
6. Huelsman Word Discrimination Test Score
7. Socioeconomic Rating
8. Teachers' evaluation grade

In order to examine the general characteristics of the data and to secure information pertaining to the questions presented in Chapter I, the Pearson Product Moment statistic was selected. Pearsonian intercorrelations, using the above defined variables, were obtained—on teachers, boys and girls, respectively.

On the recommendation of Dr. James Naylor, Associate Professor in Psychology, The Ohio State University, analyses of variance using the Standard Repeated Measure design were run to obtain the necessary data to test the hypotheses defined in Chapter I. Two analyses were run; the first using children's error scores as the dependent variable; the second, using children's response times as the dependent variable. The independent variables in both analyses were: teachers' cognitive tempo (reflective or impulsive), teachers' experience (high, above eight years; low, below eight years) and sex of the children.

Summary

The present investigation was comprised of forty-three first grade teacher and three hundred sixty beginning school children. The final data analysis, however, was confined to the data of twenty teachers and one hundred and sixty children. The teachers were
classified as either reflective (ten) or impulsive (ten) on the basis of the adult MFF, and eight children (four boys and four girls) were randomly chosen from their respective classes. The major teacher variables investigated were response time and error scores on the MFF, age, and teaching experience; the student variables were: response time and error scores on the two MFF tests, pre and post reading achievement scores, socioeconomic ratings and teacher evaluation grades. The Pearson Product Moment and an analysis of variance were proposed for the treatment of the data.
CHAPTER III

FINDINGS AND DISCUSSION

General Characteristics of the Reflection-Impulsivity Dimension

Before an investigation of the hypotheses could be undertaken, it was necessary to review the general characteristics of the reflection-impulsivity dimension in order to determine whether the present data are in agreement with the previous work in the area. Specifically, it was necessary to investigate the relationship between response time and error scores on the MFF. The relationship in previous literature has been found to be negative and hence, a negative correlation between response time and error scores can be considered a necessary general characteristic of the reflection-impulsivity dimension.

In order to determine the general characteristics of the dimension, then, Pearsonian intercorrelations were obtained on teachers, and boys, and girls, respectively. The pertinent data regarding the specific questions defined concerning the general characteristics of the dimension are presented in Tables 2, 3, 4, and 5.

1. Do the data support the previous research concerning the reflection-impulsivity dimension? In particular, is Kagan's postulation of a significant negative correlation between response time and perceptual recognition supported by the data?

Findings. Table 2 presents the correlation coefficients for the MFF response time and error scores of teachers, boys, and girls.
TABLE 2

Correlation Coefficients for MFF Response Time and Errors

<table>
<thead>
<tr>
<th>Variable</th>
<th>Correlation Coefficient</th>
<th>Significance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>Pre Response</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time/Errors</td>
<td>-.53</td>
<td>-.59</td>
</tr>
<tr>
<td>Post Response</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time/Errors</td>
<td>-.37</td>
<td>-.48</td>
</tr>
<tr>
<td>Pre/Post Response</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>.13</td>
<td>.70</td>
</tr>
<tr>
<td>Pre/Post Errors</td>
<td>.24</td>
<td>.23</td>
</tr>
</tbody>
</table>

The coefficients were taken from the intercorrelation matrices presented in Tables 3, 4, and 5. A high negative correlation ($r = -.88$), significant at the $.001$ level, was obtained between teachers' response time and error scores. Also, both pre and post test response time and error scores were negatively related for both boys and girls (boys: pre, $r = -.53$ and post, $r = -.37$; girls: pre, $r = -.59$ and post, $r = -.48$); all significant at the $.01$ level. However, pre and post response time was highly correlated for girls only ($r = .70$); the boys' scores were not significantly related ($r = .13$). Pre and post error score relationships were significant at the $.05$ level for both boys ($r = .24$) and girls ($r = .23$).

Conclusion. The significant negative correlations obtained between response time and error scores on the MFF for teachers, boys, and girls, respectively, indicate that the present data are in agreement
with the findings of previous studies concerning the reflection-impulsivity dimension. The present findings not only add support to the reliability of the MFF as a test for the measurement of reflection impulsivity, but also, add support to the acceptance of the findings related to the specific hypotheses investigated herein.

2. What is the relationship between teacher age, teaching experience, and teachers' reflective impulsive disposition?

Findings. The intercorrelation matrix for the teacher variables is shown in Table 3 (N = 43).

**TABLE 3**

Intercorrelations Among Teacher Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Response Time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Errors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Experience</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p < .05  
** p < .01  
*** p < .001

The table indicates that teacher age and experience do not significantly affect the response time variable (r = -.02 and r = -.13, respectively). Similarly, these variables have little effect on MFF error (r = .01 and r = .11). As would be expected, a positive relationship exists between age and experience (r = .55). As stated previously, a
highly significant negative relationship \((r = -0.88)\) is found between response time and errors; that is, the longer the response, the fewer the errors.

**Conclusion.** The non-relatedness of the teacher variables, age and experience, to MFF response time and error scores lends support to the previously postulated independent and fundamental nature of the reflection-impulsivity dimension.

3. What is the relationship between children's socio-economic rating and the reflection-impulsivity dimension?

**Findings.** Tables 4 and 5 report the data pertinent to the socioeconomic variable. Boys' socioeconomic rating was nonsignificantly related to the pre and post response time \((r = .01\) and -.14\) and also to pre and post error scores \((r = -.17\) and \(r = .01\)). Similarly, correlations of -.12 and -.00 between girls' socioeconomic rating and pre and post response time, and correlations of -.02 and -.18 between girls' socioeconomic rating and pre and post error scores were nonsignificant. The other boys' variable significantly related to socioeconomic rating was Word Discrimination. The Metropolitan and teacher evaluation variables were significantly related to the girls' socioeconomic rating.

**Conclusion.** Again, the non-relatedness of the students' socio-economic variable to the MFF response time and error scores, lends support to the independent and fundamental nature of the reflection-impulsivity dimension.
### TABLE 4

Intercorrelations Among Student (Boys) Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pre Errors (MFF)</td>
<td></td>
<td>.53*</td>
<td></td>
<td>.15*</td>
<td>.36**</td>
<td>.24*</td>
<td>.17*</td>
<td>.29**</td>
</tr>
<tr>
<td>2. Pre Response Time (FF)</td>
<td></td>
<td>.24*</td>
<td>.13*</td>
<td>.20*</td>
<td>.01*</td>
<td>.01*</td>
<td>.13*</td>
<td></td>
</tr>
<tr>
<td>3. Post Errors (MFF)</td>
<td></td>
<td></td>
<td>.37**</td>
<td>.23*</td>
<td>.20*</td>
<td>.01*</td>
<td>.39**</td>
<td></td>
</tr>
<tr>
<td>4. Post Response Time (MFF)</td>
<td></td>
<td>.16*</td>
<td>.17*</td>
<td>.14*</td>
<td>.18*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Metropolitan</td>
<td></td>
<td></td>
<td>.38**</td>
<td>.04*</td>
<td>.36**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Word Discrimination</td>
<td></td>
<td></td>
<td></td>
<td>.28**</td>
<td>.39**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Socioeconomic Rating</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.07*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Teacher Evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* *p < .05
** *p < .01
### Table 5

**Intercorrelations Among Student (Girls) Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pre Errors (MFF)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- .59**</td>
<td>.23*</td>
<td>- .41**</td>
<td>- .33**</td>
<td>- .32**</td>
<td>- .02</td>
<td>- .12</td>
<td></td>
</tr>
<tr>
<td>2. Pre Response Time (FF)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- .35**</td>
<td>.70**</td>
<td>.27*</td>
<td>.21</td>
<td>- .12</td>
<td>.27*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Post Errors (MFF)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>- .48**</td>
<td>- .48**</td>
<td>- .21</td>
<td>- .18</td>
<td>- .36**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Post Response Time (MFF)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>.40**</td>
<td>.14</td>
<td>.00</td>
<td></td>
<td>.33**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Metropolitan</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.22*</td>
<td>.88**</td>
<td>.61**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Word Discrimination</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>.09</td>
<td>.35**</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>7. Socioeconomic Rating</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.25*</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Teacher Evaluations</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>*p &lt; .05</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>**p &lt; .01</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
What is the relationship between children's reading performance and the reflection-impulsivity dimension?

Findings. The data pertinent to question four are reported in Tables 4 and 5. As indicated in the intercorrelation Table 4 (N = 80), boys receiving higher grades (teacher evaluation) tend to make significantly fewer errors on both pre and post MFF (r = -0.29 and r = -0.39, respectively). These children also showed high achievement on the Metropolitan (r = 0.36) and Word Discrimination (r = 0.39). However, there was no significant correlation (r = 0.18) with pre and post MFF response time. Interestingly enough, teacher evaluations do not appear to be biased by the children's socioeconomic status, though this variable relates to the Word Discrimination Test (r = 0.28). The Word Discrimination Test showed no relationship to any variables other than the Metropolitan (r = 0.38) and, slightly, to the pre-test error score (r = -0.24). The Metropolitan, on the other hand, was related to both the pre and post error scores (r's = -0.36 and -0.23 respectively).

Similar to the results reported in the boys' matrix, the intercorrelation matrix for girls (Table 4, N = 80) indicates that teacher evaluation was positively related to high achievement on both the Word Discrimination Test (r = 0.35) and the Metropolitan (r = 0.61). However, although post-test errors indicated a significant relationship to teacher evaluation (r = -0.36), pre-test errors (r = -0.12) did not. Also, response times pre (r = 0.27) and post (r = 0.33) were positively related to teacher evaluation for girls. Interestingly, socioeconomic rating (r = 0.25) showed a slight effect on the evaluation of girls,
For the girls, the socioeconomic rating showed no relationship to the Word Discrimination Test as it did for the boys, but rather, was significantly related to the Metropolitan ($r = .48$). Also, the Word Discrimination Test was related to the Metropolitan ($r = .22$) and to pre-test error scores ($r = -.32$) only; whereas, the Metropolitan was highly related to both the pre and post errors ($r = -.33$ and $r = -.48$) and response time variables ($r = .27$ and $r = .40$).

**Conclusion.** Unfortunately, the disparity of the data relating to the reading and teacher evaluation variables makes it necessary to assume that the incompatibility of these measurements prevents any conclusive statements regarding their relationship to each other and to the response time and error score variables.

**Discussion.** In general, the correlational data obtained in the present study strongly support the previous work in the area. As would have been predicted from Kagan's work, a high negative correlation between response time and error score on the MFF was obtained. The data, then, further substantiates the generality of the assumption that a great number of errors in perceptual tasks could be the result not only of the lack of relevant information and cognitive structures, but also could be the result of the lesser amount of time given for the evaluation of the possible solution hypotheses.

A strong support for the above reasoning is obtained by consideration of the correlation between the teachers' MFF response and error variables. Teachers maintain the same relationship between response time and error scores as children, i.e., more errors are committed if the response time is less. If one insists that the
observed increased accuracy of perceptual discrimination tasks (with fixed response alternatives, only) with age is the result of more mature cognitive structures and information, teachers, obviously, as they have more experience than children, should not have shown the same relationship between response time and error scores. If increasing accuracy of a perceptual discrimination task is to be explained by greater experience with age, the only possible prediction would be that teachers should take less time and commit fewer errors than children. However, the extremely high negative correlation between teacher response time and error scores lends support to Kagan's postulation that problem-solving accuracy is not only dependent on the possession of more mature cognitive structures, but also on the disposition to reflect on the validity of one's answer.

Hypothesis 1

Impulsive and reflective teachers, respectively, have a differential effect on the impulsive-reflective dispositions of children.

(a) With an impulsive teacher, a test of reflection-impulsivity will demonstrate a change in children's dispositions toward impulsivity.

(b) With a reflective teacher, a test of reflection-impulsivity will demonstrate a change in children's dispositions toward reflection.

Findings. In order to establish a child's position on the reflection-impulsivity dimension, the response time and error scores on the MFF were used. These two variables were analyzed to determine the movement (increase or decrease in response time and error score) of children's scores on the dimension. The scores of all the children
(reflective, impulsive, no classification) were used in the analyses.

Data on response time. The difference scores between pre and post response time on the MFF for children were analyzed using the Standard Repeated Measures design. The summary of the analysis is given in Table 6.

**TABLE 6**
Summary Table for the Analysis of Variance

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>ss</th>
<th>df</th>
<th>ms</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children's Response Time on MFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex of students (C)</td>
<td>3.600</td>
<td>1</td>
<td>3.600</td>
<td>.068</td>
</tr>
<tr>
<td>Level of experience of teachers (D)</td>
<td>136.899</td>
<td>1</td>
<td>136.899</td>
<td>2.575</td>
</tr>
<tr>
<td>Reflective-impulsive tempo of teachers (E)</td>
<td>490.000</td>
<td>1</td>
<td>490.000</td>
<td>9.217**</td>
</tr>
<tr>
<td>CXD</td>
<td>2.500</td>
<td>1</td>
<td>2.500</td>
<td>.047</td>
</tr>
<tr>
<td>CXE</td>
<td>96.099</td>
<td>1</td>
<td>96.099</td>
<td>1.808</td>
</tr>
<tr>
<td>DXE</td>
<td>608.399</td>
<td>1</td>
<td>608.399</td>
<td>11.444***</td>
</tr>
<tr>
<td>CXDXE</td>
<td>220.900</td>
<td>1</td>
<td>220.900</td>
<td>4.155*</td>
</tr>
<tr>
<td>Error (within)</td>
<td>6804.799</td>
<td>128</td>
<td>53.162</td>
<td></td>
</tr>
</tbody>
</table>

*p < .05  
**p < .01  
***p < .001

The effect of teacher tempo upon children's response time was significant at the .01 level. The table of mean differences (Table 7) reveals that the direction of the effect is toward reflectivity. However,
reflective teachers (5.80) contributed more than impulsive teachers (2.30) to the change in children's dispositions toward reflection.

**TABLE 7**

**Mean Difference Scores for MFF Response Time Variable**

<table>
<thead>
<tr>
<th>Teachers</th>
<th>Reflective</th>
<th>Impulsive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>10.90</td>
<td>2.55</td>
</tr>
<tr>
<td>Girls</td>
<td>6.45</td>
<td>3.30</td>
</tr>
<tr>
<td>Both</td>
<td>8.68</td>
<td>2.93</td>
</tr>
</tbody>
</table>

Further analysis, using the Newman-Keuls method (Winer, 1962) indicates that reflective and impulsive teachers differ significantly in their effect on children's response time \( p < .01 \). The interaction of experience with the tempo variable increases the confidence level to \( .001 \). Further breakdown of this interaction using the Newman-Keuls method indicates that the significance is contributed mainly by reflective teachers with high experience \( p < .01 \). No other group, that is impulsive teachers with high or low experience nor reflective teachers with low experience, was significantly different from the other.

The teacher tempo, experience of the teacher, and sex of the children interaction was significant at the .05 level. Again, using the Newman-Keuls method, further analysis indicates that no difference was found among impulsive teachers of either high or low experience on girls and reflective teachers of low experience on boys. All other
groups were significantly different from these groups and from each other. The greatest effect toward reflectivity being found on boys by reflective teachers with high experience ($p < .01$) was noted. Also, when sex is taken into consideration, movement toward impulsivity can be observed. That is, impulsive teachers of high experience modify boys' response time toward impulsivity.

Data on error scores. Since the data obtained on the pre and post tests of the MFF error scores were significantly correlated ($r = .19$), an analysis of variance could not be performed on the difference scores. A significant correlation between pre and post tests implies that, at least for a few subjects, any further increase in scores from pre to post test situation was not possible, e.g., they were scoring the maximum possible score in the pre-test. This could have lead to confounding and would have affected the total residual score. Hence, a regression equation was obtained using pre scores as predictor for the difference score which was obtained by subtracting pre scores from post scores. The regression equation was obtained for each subject and residual error was calculated for each subject using the following formula: $Y - \bar{Y} = \text{residual}$. The analysis of variance (Repeated Measures) was then performed on the obtained residual scores. The summary of the analysis is given in Table 8. As the table indicates, no significant effects were found in the analysis. The only variable which approached significance was the effect of the experience of the teacher.
**TABLE 8**

Summary Table for the Analysis of Variance

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>ss</th>
<th>df</th>
<th>ms</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children's Error Scores on MFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex of students (G)</td>
<td>.625</td>
<td>1</td>
<td>.625</td>
<td>.017</td>
</tr>
<tr>
<td>Level of experience of teachers (D)</td>
<td>90.000</td>
<td>1</td>
<td>90.000</td>
<td>2.450</td>
</tr>
<tr>
<td>Reflective-impulsive tempo of teachers (E)</td>
<td>2.024</td>
<td>1</td>
<td>2.024</td>
<td>.055</td>
</tr>
<tr>
<td>G x D</td>
<td>1.599</td>
<td>1</td>
<td>1.599</td>
<td>.043</td>
</tr>
<tr>
<td>G x E</td>
<td>4.225</td>
<td>1</td>
<td>4.225</td>
<td>.115</td>
</tr>
<tr>
<td>D x E</td>
<td>3.600</td>
<td>1</td>
<td>3.600</td>
<td>.098</td>
</tr>
<tr>
<td>G x D x E</td>
<td>2.499</td>
<td>1</td>
<td>2.499</td>
<td>.068</td>
</tr>
<tr>
<td>Error (within)</td>
<td>4695.600</td>
<td>128</td>
<td>36.684</td>
<td></td>
</tr>
</tbody>
</table>

*p < .05  
**p < .01  
***p < .001
Conclusion. It can be concluded from the above data that impulsive and reflective teachers have a differential effect on the response time factor of the reflective-impulsive disposition of children. Specifically, reflective teachers appear to be more effective than impulsive teachers in producing change in children's reflective-impulsive dispositions. However, teachers' cognitive tempos did not affect the error score factor of the reflection-impulsivity dimension.

In regard to sections (a) and (b) of hypothesis 1, it can be accepted that reflective teachers significantly affect a change in children's reflective-impulsive dispositions toward reflectivity. However, impulsive teachers affect only boys' reflective-impulsive dispositions toward impulsivity.

Therefore, in general, hypothesis 1 can be accepted. However, the hypothesis is qualified in terms of response time and boys' movement toward impulsivity.

Discussion. It was expected that teachers would modify children's dispositions toward their own cognitive tempo. However, the trend is observed with reflective teachers and only slightly with impulsive teachers (restricted to boys). Regardless of the cognitive tempo of the teacher, in general, a movement toward reflectivity is observed in the children.

The data are difficult to explain as the predicted results are obtained only with one component of the dimension (reflectivity); whereas the other component (impulsivity) in general produces the opposite results, albeit to a lesser degree. One way of giving the
data some meaning is to refer to the developmental nature of the dimension. Children are supposed to become more reflective with age. Hence, it can be argued that the influence of the impulsive teacher was not strong enough to counteract the developmental trend. Two problems ensue with such reasoning. First, saying that the influence of the impulsive teacher was not strong enough to counteract the developmental trend is to refer to some unknown factor strong enough to counteract the influence of the reinforcing agent, i.e., teacher. Second, if one considers the data on boys only, there is some evidence that children working with impulsive teachers do show a trend toward impulsivity. The question then becomes one of why in one case the developmental trend is obtained whereas in the other it is not. Perhaps it is possible that children who have developed a definite cognitive tempo are affected differently by the teacher than children who have not developed a definite cognitive tempo.

The following hypothesis will be concerned with the cognitive similarity of teacher and child. As stated in Chapter I, a lack of relevant information concerning the variables related to model identification makes it impossible to hypothesize the directionality of the modification.

**Hypothesis 2**

The reflective-impulsive disposition of a child will be modified if there exists a similarity or dissimilarity between the cognitive tempo of the child and that of the model (teacher).

(a) If the teacher is reflective and the child is reflective, the cognitive tempo of the child will be modified.
(b) If the teacher is impulsive and the child is reflective, the cognitive tempo of the child will be modified.

(c) If the teacher is reflective and the child is impulsive, the cognitive tempo of the child will be modified.

(d) If the teacher is impulsive and the child is impulsive, the cognitive tempo of the child will be modified.

**Findings.** To investigate whether or not an initial similarity between student and teacher on the reflection-impulsivity dimension might affect a child's continued specific placement on the dimension, *t* tests were used. Children used in the analysis were only those who had been classified as impulsive (both response time below mean and error score above mean) or reflective (both response time above mean and error score below mean) on the MFF pre-test. Those children who were non-classified in the beginning of the present investigation were not used in the analysis. The Student *t* test for Correlated Observations was performed on response time scores for boys and girls separately.

Data are presented in Table 9, and are discussed in regard to the four sections of hypothesis 2.

(a) If the teacher is reflective and the child is reflective, the cognitive tempo of the child will be modified.

Data: As is indicated from Table 9, if reflective children are assigned to reflective teachers the increase in response time is significant at the .0005 level. Sex of the children does not seem to contribute any significant difference.
TABLE 9

Mean Gain Scores for MFF Response Time

<table>
<thead>
<tr>
<th>Teachers</th>
<th>Reflective</th>
<th>Impulsive</th>
<th>Reflective</th>
<th>Impulsive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children</td>
<td>Boys</td>
<td>Girls</td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>Number</td>
<td>8</td>
<td>12</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>Mean</td>
<td>1.12</td>
<td>1.67</td>
<td>8.71</td>
<td>3.85</td>
</tr>
<tr>
<td>Significance Level</td>
<td>.0005</td>
<td>.0005</td>
<td>.0005</td>
<td>.0005</td>
</tr>
</tbody>
</table>

Conclusion: If the teacher is reflective and the child is reflective, the cognitive tempo of the child is significantly modified toward reflectivity.

(b) If the teacher is impulsive and the child is reflective, the cognitive tempo of the child will be modified.

Data: If the teacher is impulsive and reflective children are assigned to her, children's cognitive tempos are not as significantly affected as the cognitive tempo of reflective children assigned to reflective teachers. Interestingly, reflective girls working with impulsive teachers do not show any change in response time, while reflective boys show a decrease in response time (-.63, p < .05). Conclusion: If the teacher is impulsive and the boy is reflective, the cognitive tempo of the boy is slightly modified toward impulsivity.

(c) If the teacher is reflective and the child is impulsive the cognitive tempo of the child will be modified.
Data: Both impulsive boys and impulsive girls assigned to reflective teachers show a highly significant increase ($p < .0005$) in response time. Conclusion: If the teacher is reflective and the child is impulsive, the cognitive tempo of a child is significantly modified toward reflectivity.

(d) If the teacher is impulsive and the child is impulsive, the cognitive tempo of the child will be modified.

Data: Both impulsive boys and impulsive girls assigned to impulsive teachers show a significant increase in response time ($p < .05$ and $p < .01$, respectively). However, if impulsive children are working with impulsive teachers, the gain in response time appears to be less than the gain obtained with impulsive children assigned to reflective teachers. Conclusion: If the teacher is impulsive and the child is impulsive, the cognitive tempo of the child is modified toward reflectivity.

Discussion. Children evidence change in cognitive tempo if they are similar to the model (teacher) and also if they are dissimilar to the model. Sex differences were found in that boys showed more change than girls.

Although the direction of change in children's dispositions, in general, was very similar to the findings for hypothesis 1, the data become most difficult to interpret in light of model similarity. For example, since all teachers were women, it could be expected that girls would evidence more change in tempo than boys. Such was not observed. Also, it could be expected that children who are similar
to the model (i.e., reflective-reflective) rather than dissimilar
(i.e., reflective-impulsive) would show more change toward the direc-
tion of the cognitive tempo of the teacher. However, although there
was no difference between impulsive and reflective children in reflex-
tive teachers' classes, in impulsive teachers' classes reflective
rather than impulsive children moved toward impulsivity. Also,
impulsive children in impulsive teachers' classes evidenced a trend
toward reflectivity.

It seems logical to assume that whether or not a teacher will
be imitated will depend on how desirable the behavior of a teacher is
from a child's point of view, and how consistent she has been in re-
inforcing the imitation. Furthermore, though a teacher's behavior
may be desirable and consistent in the reinforcement of imitation,
there always remains the possibility that a child may accept some-
one else, namely the father, mother, or friend as a model for imitation.
Therefore, it is difficult to say, particularly in a naturalistic
study, whether or not the child has actually chosen the teacher as a
model with whom to identify. Hence, one can only assume that the
cognitive tempo similarity of teacher and child provides some basis
for imitation. However, no conclusions can be drawn from the data
to define more clearly such an assumption.

Therefore, because of the disparity of the data, the only
immediate conclusions that can be drawn are that children who have
definite cognitive tempos appear to be affected more by reflective
and impulsive teachers than are children who have not developed a
definite cognitive tempo. Also, reflective teachers produce more change in children both similar and dissimilar to themselves than do impulsive teachers. Impulsive teachers affect more change toward impulsivity in reflective children than in impulsive children. Reflective teachers affect change only toward reflectivity; impulsive teachers affect change toward both reflectivity and impulsivity.

Summary

The following conclusions can be drawn from the findings:

1. The general characteristics of the reflection-impulsivity dimension obtained in the present investigation are in agreement with the previous research related to the dimension. Specifically, the data lend support to the independent and fundamental nature of the reflection-impulsivity dimension and to the acceptance of the dimension as being influential in the production of perceptual recognition errors.

2. In terms of response time, reflective and impulsive teachers have a differential effect on the modification of children's reflective-impulsive dispositions. Specifically, reflective teachers (particularly those with teaching experience over eight years) are more effective in modifying children's dispositions than are impulsive teachers.

3. Modification of the dimension has been obtained in both directions. That is, a change in children's cognitive dispositions toward reflectivity and toward impulsivity were obtained. Specifically, reflective teachers affect change in children's dispositions
toward reflectivity only; however, impulsive teachers affect change in children's dispositions toward impulsivity and reflectivity. The movement toward impulsivity was observed only with boys.

4. Children evidence change in cognitive tempo if they are similar to the model (teacher) and also if they are dissimilar to the model. However, reflective teachers produce more change in children both similar and dissimilar to themselves than do impulsive teachers. Regarding the direction of change, reflective teachers modify both reflective and impulsive children toward reflectivity; impulsive teachers modify reflective rather than impulsive children toward impulsivity.
CHAPTER IV

SUMMARY AND IMPLICATIONS FOR RESEARCH

Summary

The present investigation was designed to study the general characteristics of the reflection-impulsivity dimension and to investigate the effect of teachers' cognitive tempo on the development of the reflective-impulsive disposition of children. The subjects of the study were forty-three first-grade female teachers and three hundred and sixty beginning school children. The final data analysis was confined to the information obtained from twenty teachers (ten reflective and ten impulsive) and one hundred and sixty children.

The teachers were classified as either reflective or impulsive on the basis of the adult form of the Matching Familiar Figures Test, and eight children (four boys and four girls) were randomly chosen from their respective classes. The major teacher variables investigated were response time and error scores on the MFF, age, and teaching experience; the student variables were pre and post response time and pre and post error scores on the MFF, pre and post reading achievement scores, socioeconomic ratings, and teacher grades.

The following conclusions were derived from the evidence presented:

1. The significant negative correlations obtained between response time and error scores on the MFF for teachers, boys, and
girls, respectively, indicates that the present data are in agreement with the findings of previous research related to the reflection-impulsive dimension.

2. The non-relatedness of the teacher variables of age and teaching experience, and the student socioeconomic variable to the MFF response time and error scores lends support to the previously postulated independent and fundamental nature of the reflection-impulsivity dimension.

3. In terms of response time, reflective and impulsive teachers have differential effect on the modification of children's reflective impulsive dispositions. Specifically, reflective teachers (particularly those with teaching experience over eight years) are more effective in modifying children's dispositions than are impulsive teachers.

4. Modification of the dimension has been obtained in both directions. That is, a change in children's cognitive dispositions toward reflectivity and toward impulsivity were obtained. Specifically, reflective teachers affect change in children's dispositions toward reflectivity only; however, impulsive teachers affect change in some children's dispositions toward impulsivity and in some toward reflectivity. The movement toward impulsivity is observed only with boys.

5. Children evidence change in cognitive tempo if they are similar to the model (teacher) and also if they are dissimilar to the model. However, reflective teachers produce more change in children
both similar and dissimilar to themselves than do impulsive teachers. Regarding the direction of change, reflective teachers modify both reflective and impulsive children toward reflectivity; impulsive teachers modify reflective rather than impulsive children toward impulsivity, and impulsive children toward reflectivity.

Interpretation of the data has been in terms of learning theory which appears adequately to account for the majority of the findings.

Speculative Consideration of the Data

Kagan (1966) cites four major reasons for the modification of behavior, namely: "(a) the desire for an external reinforcement, such as praise, love, money, toys, candy, etc., (b) the desire to avoid an unpleasant experience, (c) the desire to be correct and/or to be competent at a task, and (d) the desire to maximize similarity to a model" (p. 2). There is no implication that one method will bring different results from another. Nor is there any suggestion as to what will happen, in terms of behavior modification, to a very young child who can be classified as having developed either an impulsive or reflective cognitive disposition. Furthermore, there is no information as to what will happen if two different reasons for modification are pitted against each other. For example, what would happen if the child desires to maximize his similarity with the model but the reinforcement for that kind of imitation is erratic?

Considering this lack of information, the only reasonable speculation regarding the disparity of the data (in particular the data on model similarity) is that, possibly, because of the nature
of the impulsive teacher, she may not be consistent in providing reinforcement for a child's impulsive behavior. Hence, the attempted impulsive behavior on the part of the child will be unreinforced and consequently, unadopted. It would seem, then, that an impulsive teacher would not be very effective as a model capable of producing change in others.

Some support for this speculation can be obtained by considering the role that the teachers' experience plays in the modification of children's cognitive tempo. Surprisingly, even with high experience, the impulsive teachers are not very effective in producing change. On the other hand, experience appears to enable the reflective teacher to be more effective in producing change in children's cognitive dispositions toward reflectivity.

Therefore, a child may find it very difficult to imitate an impulsive teacher's behavior. Her inconsistency could possibly create more stimulus and response uncertainty for the child and, hence, at least implicitly, the child would go through a greater amount of decision making in order to decide what kind of behavior is appropriate in a variety of situations. Paradoxically, this will lead to greater response time on the part of the child.

It is important to consider children who are classifiable as impulsive and remain impulsive with an impulsive teacher. Since these children already have a high degree of similarity with the model, erratic reinforcement may not be very effective as a means of creating stimulus or response uncertainty. Therefore, it is perfectly possible
after all, that the impulsive child develops a greater tolerance for ambiguity.

Tentative, though indirect, support for the idea of greater tolerance for ambiguity on the part of an impulsive child can be obtained from Kagan's work (1963) with analytic conceptual style. It was found that men (adults) who preferred analytic concepts over global concepts were those who tended to delay in response to items on the CST. Among children, high positive correlations were found to exist between reflection and analytic conceptual style preference. Quite possibly, those people who tend to favor global concepts, i.e., those of a more abstract nature, are more tolerant of ambiguity and also are impulsive.

If one accepts the teacher as an extremely important reinforcer to the child, particularly regarding academic achievement, then the most difficult aspect of the data to explain is the information pertaining to the child who shows no trend toward reflectivity. Another disquieting aspect of the data is the sex difference found, i.e., boys, almost exclusively, show a movement toward impulsivity. The above-mentioned line of speculation will be expanded to account for the change in cognitive tempo toward impulsivity.

As stated previously, an impulsive person (excluding the possibility of maladjusted behavior and constitutional problems such as brain-damage) might very well be one who is tolerant of ambiguity. With this information, consider for a moment another area of study which has been troublesome to the educator, the creative child.
Torrance (1966) has stated that the creative child appears to have, among other attributes, a tolerance for ambiguity. Furthermore, the creative child prefers intuitive over sense perception and has no motivation to achieve in situations of conformity. Moreover, boys tend to be more creative than girls. Two questions commonly appear in the literature: (1) what happens to the creativity so apparent in children and (2) why do many creative children fail academically.

In light of the above information, the data regarding the impulsive child is most interesting. There seems to be some indication (Kagan, 1965) that impulsive children are prone to have difficulty in academics, specifically reading. The same child makes a great number of perceptual recognition errors in a variety of tasks and, quite possibly, is tolerant of ambiguity. Also, more boys than girls tend toward impulsive behavior.

Regarding the educational system, it is common knowledge that schools in general place a premium on memory, accuracy, neatness, and cautiousness. Such tasks demand a reflective cognitive tempo. Torrance (1965) believes they are not conducive to creativity.

The conclusion that all impulsive children are creative would indeed be foolish; however, the possibility that many creative children are impulsive may be a worthwhile investigation. For example, Kagan constantly reiterates that one should not consider the reflective child as the "better" or "brighter" child and that not all tasks require a strong reflective orientation. If one assumes, since it is intuitively attractive, that the arts are less demanding of a reflective orientation than the sciences, the question then becomes one of to what
degree and in what proportion. Quite possibly the creative genius (regardless of his field) is one who, granting sufficient intellectual capacity, is able to tolerate an extreme amount of ambiguity and is able to vacillate readily between the two modes of attack to problem solving.

It appears then, that it would be most interesting and rewarding to investigate more thoroughly the small group of children who have a tendency toward impulsivity in the face of a tremendous amount of reinforcement for reflective behavior.

**Implications for research**

The accumulated evidence from the research related to the reflection-impulsivity dimension is relatively conclusive in establishing it as a fundamental cognitive disposition. The dimension has shown remarkable intertask stability and generality, and has evidenced its influence on the production of analytic conceptual groupings and recognition errors. If one is to accept the dimension as an important variable in the problem-solving process, however, a variety of parametric research must be completed in order to appreciate more fully its impact. The following suggestions for research are recommended.

1. The present study demonstrates evidence for the modifiability of the reflection-impulsivity dimension. Before the effects of teacher-child interaction can be understood fully, however, further research is needed to determine more adequately the behavioral characteristics of teachers and children classified as reflective and impulsive. For example, although common sense would dictate that a
reflective teacher will unconsciously encourage her students to consider alternative solutions in their presentations, such a statement stands on tenuous ground without the support of empirical research.

2. Since the conceptual tempo of a child can be modified, not only toward reflectivity but also toward impulsivity, it now becomes a crucial question for educators to investigate more completely the relationship between impulsivity and reading problems. Oftentimes, many reading difficulties of a child are relegated to the ambiguous category of emotional problems, if all other constitutional factors have been ruled out. Such is certainly unfair to the child who may have established only an impulsive tempo. Unfortunately, the present investigation, because of inadequate controls on reading ability, was unable to report the effects of teachers' cognitive dispositions on reading. However, the significant effects of teachers upon the reflective-impulsive disposition of children certainly indicates the high possibility of accompanying reading difficulties in regard to impulsive children.

3. Since the most significant effects of teachers' tempo was observed in the "model similarity" groups, it is suggested that a study similar to the present investigation be initiated. The use of experimental groups of children and teachers, matched for similarity and dissimilarity of cognitive tempo, and a control group of teachers and children who can not be classified as either impulsive or reflective is suggested. Rigid controls for intellectual ability and reading achievement would be necessary. In this manner, one will be able to obtain a better understanding of the differential effects of teachers'
pace on the mastery of academic skills and if such effects are in any way deleterious to the child of a specific conceptual tempo. Such a study would leave the educator little doubt as to his responsibility for being attuned to the conceptual tempo of a child and the subsequent tailoring of a classroom presentation to meet the needs of the child.

4. Two other educational "problems" would be worthwhile to investigate in regard to the reflection-impulsivity dimension: one, as previously mentioned, the creative child; secondly, the "behavior problem" child. The "behavior problem" child in the educational setting very often is one who can be identified as emotionally handicapped or intellectually retarded. Both classes of children have been referred to as "impulsive." It would be interesting to know if the emotionally handicapped and/or intellectually retarded child shows impulsive behavior in terms of sensory-motor reaction time tests and/or the conceptual reflection-impulsivity tests. Also, if one can assume that the impulsive teacher demands a tolerance of ambiguity on the part of her students, the effects of the impulsive teacher on the "behavior problem" child might be most damaging; that is, if one accepts the current philosophy which maintains that "behavior problem" children are in need of an extremely structured environment. On the other hand, the creative child might be hampered by a structured environment and would find learning a more valuable experience with, perhaps, an impulsive teacher.

It becomes evident, then, that further investigation into the understanding of the reflection-impulsivity dimension not only may lead
to a better understanding of how to educate the "normal child" but also may serve as a useful tool in the understanding and education of the exceptional child.
BIBLIOGRAPHY
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The figures reproduced in this Appendix have been reduced in size and, actually, represent two pages from the test. The object marked "standard" is presented to the subject; the identical match must then be located by the subject from the array of eight stimuli (which are presented on a separate page).
Appendix B: A Sample Item of the Matching Familiar Figures Test, Children’s Version, I*

*The figures reproduced in this Appendix have been reduced in size and, actually, represent two pages from the test. The object marked “standard” is presented to the subject; the identical match must then be located by the subject from the array of six stimuli (which are presented on a separate page).
The figures reproduced in this Appendix have been reduced in size and, actually, represent two pages from the test. The object marked "standard" is presented to the subject; the identical match must then be located by the subject from the array of six stimuli (which are presented on a separate page).