A COMPARATIVE STUDY OF READING, IMPULSIVITY AND LEARNING DISABILITIES

By

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CHAPTER I

THE RESEARCH PROBLEM

Introduction

Parents and educators have for centuries recognized the inability of some children to learn normally. Among these were the blind, deaf, physically and mentally handicapped, speech defective, and emotionally disturbed. Special education has concentrated on these identified disorders by expanding services and re-structuring the educational process to meet the specific needs. As such programs became firmly established in the schools, it was discovered that there remained children who were apparently normal physically and intellectually, but to whom learning was a difficult operation. Detailed study of these children revealed that they had central process dysfunctions which hindered learning by traditional methods. The resulting classification of what is now called the "learning disabled" (LD) child had its initial beginning with the publication of Psychopathology and Education of the Brain-Injured Child (Strauss and Lehtinen, 1947). Since that time the term brain-injured child has fallen under much criticism because of its inappropriateness in describing the problem (Stevens and Birch, 1957). A number of alternative terms have been recommended to overcome the difficulties associated with the term brain-injured child. Among these are neurophrenia (Doll, 1951), Strauss syndrome (Stevens and Birch, 1957), the other child (Lewis et al., 1960), minimal brain dysfunction (Clements and

Peters, 1962), and psychoneurological learning disabilities (Johnson and Myklebust, 1967). At the present, the term gaining the most acceptance is "learning disabilities," and there is now a journal, by the same name, specifically devoted to this topic.

The present study conducted in Oklahoma deals with LD children defined by that state as

> ...those children with normal or potentially normal intelligence who because of some neuro-psychological factor are noted to have learning disabilities of a perceptual, conceptual, or integrative nature. Children with major sensory and motor deficits such as the blind, deaf, the cerebral palsied, the mentally retarded or children whose learning deficit clearly is of emotional origin without concomitant neuro-psychological factors, are excluded from this category... (Oklahoma State Department of Education, 1976, p. 99).

The intellectual requirement of "normal or potentially normal" is assessed with an individual intelligence test (usually one of the Wechslers). The results are generally interpreted along the guidelines formed by Clements and Peters (1962) establishing three patterns.

The first, Pattern I, is the most common of the three and consists of subtest scatter in either or both the Verbal and Performance Scales. These children have numerous strengths and weaknesses. Pattern II is said to be present when the Verbal IQ is 15 to 40 points higher than the Performance IQ. These are children with coordination and perceptual-motor deficits. Rotations, reversals, and distortions are common in these children's writings and drawings, and awkwardness is often seen in motor activities. The least common is Pattern III. In this case Performance IQ is 10 to 30 points higher than Verbal IQ. These children have considerable difficulty expressing themselves verbally.

Among the characteristics accepted by the Oklahoma State Department of Education (1976, p. 99) as identifying the LD child are hyperactivity,

perceptual-motor impairments, emotional lability, anxiety, general coordination deficits, disorders of attention (short attention span, distractibility, perseveration), impulsivity, disorders of memory and thinking, specific learning disabilities, disorders of speech and hearing, equivocal neurological signs and electroencephalographic irregularities. According to Clements and Peters (1962) it is quite possible that perceptual disorganization may lead to many of these symptoms of which impulsivity is of specific interest here. This symptom appears to be related to the reflection-impulsivity (R-I) cognitive style proposed by Kagan et al. (1964) and defined as the tendency to reflect over alternative solution possibilities, in contrast to the tendency to make impulsive selection of a solution, in problems with high response uncertainty where several simultaneous alternatives are available.

The LD child (especially subtle LDs) are generally first spotted by teachers. This typically happens because school tends to emphasize the learning weakness by the formal establishment of criteria. While LD children may have difficulties in any of the learning areas, "one of the major scholastic difficulties of children with learning disabilities is that they are poor in reading" (Lerner, 1971, p. 187). Because of partial similarities in the sight and sound of words, there generally is some uncertainty as to the proper pronunciation of words by persons learning to read. Previous research (Egeland, 1974; Kagan, 1965b; Nadelman and Wallace, 1973) has found a relationship between R-I and reading, but such research has not specifically dealt with LD children.

Statement of the Problem

Teachers have posed many questions to the author concerning LDs

and their problems. Typical questions ask why and what: "We've been over this dozens of times. Why can't he learn it?" "She knew it yesterday, why not today? "Why won't he pay attention and think about what he's doing?" "I've tried everything I know. What can I do to get her to learn?" Such questions give evidence to the frustration of teachers dealing with LD children. Their lack of success demonstrates the need for a better understanding of the effects of such disabilities in learning and the need for investigations directed toward teaching strategies. It is hoped that the information resulting from this study will help provide answers concerning the problems of LD children leading to effective prevention and remediation.

Children with learning disabilities tend to be described as impulsive and generally have difficulty with reading. A gap exists in the knowledge of the LD child's reading errors, empirical verification of impulsivity in LDs, and the possible relationship of impulsivity and reading in LDs.

Purpose of the Study

The LD phenomenon is relatively new in terms of its official recognition, identification techniques, causation theory, prevention, effects on learning, and correction or remediation. It is imperative that research continue its quest for answers. The specific purpose of this study, therefore, is to determine the reading error types of LD children, validate the reported impulsivity, and investigate the possible relationship between reading and impulsivity in LDs.

Definition of Terms

Cognitive style is considered to be a consistent ordering and processing pattern of environmental stimuli through which knowledge is acquired.

Ending errors are word-recognition errors made within the last third of a word.

Impulsivity is the tendency to make quick responses in problems of high response uncertainty where several solutions are available.

Initial errors are word-recognition errors that occur within the first third of a word.

Learning disability is considered to pertain to children of normal or potentially normal intelligence who have some perceptual, conceptual, or integrative deficit which interferes with learning.

Maturational lag point of view believes that all individuals have a natural development and time for their own maturation of skills. What may be considered a learning problem, may simply be lag in certain maturation processes.

Middle errors occur when a word-recognition error is made in the middle third of a word.

Minimal brain dysfunction refers to the view that deviations or impaired neurological connections in the central nervous system result in learning or behavioral problems.

Orientation errors are word-recognition errors that involve two letters in a word exchanging places.

Perception is the capacity for comprehension and the extraction of meaning through the process of interpreting sensation.

Reflection is the tendency to delay responses in problems of high response uncertainty where several solutions are available.

Response errors refer to the total number of errors made on the Matching Familiar Figures test.

Response time refers to the length of time between exposure of the stimuli on the Matching Familiar Figures test and the overt response of the subject.

CHAPTER II

REVIEW OF LITERATURE

Introduction

In a lengthy study on differences in analytic and nonanalytic attitudes, Kagan et al. (1964) introduced the R-I cognitive construct as being one of the many determinants of the analytic-nonanalytic attitude. Being less confounded than the analytic-nonanalytic dimension, he turned his attention to the exploration of R-I.

Kagan used decision time in the conceptualization of R-I where "the reflection-impulsivity dimension describes the child's consistent tendency to display slow or fast response times in the problem situations with high response uncertainty" (Kagan, 1965a, p. 134). This proposed cognitive style has come to be defined as the tendency to reflect over possible alternative solutions, in contrast to the tendency to make impulsive selection of a solution, in problems with high response uncertainty where several solutions are available simultaneously or in close proximity (Kagan et al., 1964). The reflective child is more capable of delaying his immediate decision while considering other possible solutions compared to the impulsive child who responds to the first possible solution.

The instrument most often used to measure R-I is the Matching Familiar Figures (MFF) test (Kagan et al., 1964). This match-to-standard format assesses time to first response and number of errors.

The operational definition most widely used in research includes both response time and errors where fast/inaccurates are labeled impulsive and slow/accurates are termed reflective. In studies that use only the response time it is assumed that long response times are related to few errors (Kagan et al., 1964). There has, in fact, been criticism (Block et al., 1974) of using both time and errors as a combined measure of R-I due to the discrepancy between R-I conceptualized in terms of response latency and its operational use in terms of accuracy as well as latency. The multiplicity of elements affecting response error could yield factors "far different and more powerful than what is indexed by response time" (Block et al., 1974, p. 613).

The study of individual differences in problem solving among children has expanded beyond the view of being the result of differences in basic intelligence. Motivational factors, perception, sensory modalities, anxiety, and cognitive styles have all been implicated in the ability to solve problems. One such construct, R-I, is concerned with the degree that a child reflects over the adequacy of a solution to a problem. According to Kagan (1966) problem solving involves four phases. First, the problem must be decoded and comprehended. Secondly, a hypothesis is formed about the problem thus giving direction toward a solution. At this point execution of the hypothesis produces a solution to the problem. The fourth phase concerns the evaluation of the solution selected. The R-I dimension should, therefore, affect phases 2 and 4 in which the hypothesis is formed and the solution is evaluated. "Decision time is often a good index of the degree to which a problem solver pauses to evaluate his answer" (Yando and Kagan, 1970).

General Reflection-Impulsivity Findings

The tendency to reflect and distinguish relevant aspects of a stimulus and solutions have been shown to be important in the production of analytic concepts (Kagan et al., 1964). The belief that reflective children evaluate the stimuli more than impulsives was supported in a study (Kagan et al., 1966) which found that the longer response time was associated to a greater number of glances at the stimuli. Several studies have investigated how reflective and impulsive children direct their attention on MFF-like tasks through the use of eye cameras and focusing equipment (Ault et al., 1972; Drake, 1970; Siegelman, 1969). The results indicate that reflectives examine more of the variants and have more eye fixations on the variants than impulsives. A higher percentage of the reflectives' total viewing time is spent comparing pairs of stimuli which include the standard and a variant. They also observe more pairs, and look back and forth between standard and varient more often. The cautious strategy of reflectives in gathering more information and evaluating it is in opposition to the less systematic and more global viewing of impulsives.

Research on R-I has spread to tasks of a nature unlike the MFF. While R-I was conceived as functioning in problem situations where alternative solutions were present, it has also been noted in situations of self-generated alternatives (Denney, 1973; Kagan, 1965a; Mann, 1973). Although the correlations between such tests and the MFF were not always high, the findings have implications to the reading process discussed in the next section.

Several studies (Ault, 1973; Kagan, 1965a; Kagan et al., 1964) indicate that R-I is relatively stable between children with all children

becoming more reflective with age. In other words, a child's relative standing within a group remains more or less constant while the group as a whole tends to increase response time and decrease errors with age.

Messer (1974) sums up the research findings on the sex differences in reflectives and impulsives by noting the lack of consistency. His table of correlation comparisons compiled from numerous studies indicates no persistent sex difference in response time or errors.

In an early study, Kagan et al. (1964) hypothesized the antecedents of R-I. In a later study, Kagan (1966) explored the hypothesis concerning the sources of anxiety that he felt could make one child reflective and another impulsive. He assumed that the reflective child was guided by anxiety over possible error, while impulsives were directed by desire of quick success where slow is associated with incompetence. His results gave minimal support to the hypothesis that reflectives are more anxious about the quality of performance than impulsives. Messer (1970), Reali and Hall (1970), Ward (1968), and Weiner and Adams (1974) also found support consistent with Kagan.

Block et al. (1974) have suggested that there may be a relation between R-I and IQ which could account for the obtained results. Kagan (1965b, p. 610) stated that "decision times" on such tasks as MFF are "relatively orthogonal to traditional intelligence test scores," i.e., R-I is statistically independent of IQ. The correlations between response time, errors, and IQ from numerous studies were gathered by Messer (1974) and summarized. The median correlation between response time and IQ for males was .14 and .22 for females. Between errors and IQ the correlation was - .295 for males and - .335 for females. The R-I cognitive style is not highly related to IQ, but the correlation is

slightly higher for errors than time and for females than males. Messer continues to explain that part of the relationship exists because of the nature of certain IQ tests. The multiple choice format (e.g. Otis-Lennon Test) is much more similar to the MFF format than are question-answer types (e.g. Wechsler verbal scales).

Reflection-Impulsivity and Reading

When a child is learning to read he is bombarded with a multitude of seemingly similar stimuli. At the outset the child must engage in a discrimination problem to determine the differences between these new symbols, i.e., letters and words. The specific learning skill of reading becomes a problem situation wih high response uncertainty. In the previous section, it was shown that R-I is present in tasks where the subject is required to give an answer from self-generated alternatives. Such is the case that Kagan (1965b) makes concerning the development of the reading skill. Any word will elicit several word-recognition (solution) possibilities, and the child might or might not reflect on the validity of each possibility before pronunciation. Provided this is the situation, then the impulsive child should make more word-recognition errors than reflectives.

Nadelman and Wallace (1973) found children in a reading readiness class to be significantly more impulsive than children in a regular first grade class. Egeland (1974) gave further support to the influence of R-I to reading in a study which trained impulsives to increase their reflectivity. The results showed improved reading comprehension.

In a detailed study of reading and word-recognition errors, Kagan (1965b) employed an auditory-visual discrimination task. First graders

were shown a card with five words of graphemic similarity. The child was to select the correct word (given verbally) from the alternatives. The results indicated that word-recognition errors were negatively related to MFF response time and positively to errors. High-low verbal ability was assessed with the average score from the Information and Vocabulary subtests of the Wechsler Intelligence Scale for Children (WISC). Verbal ability positively predicted reading performance. Low verbal boys had a significant negative relationship between MFF response time and letter recognition errors. Six months later, verbal skills were still positively related to word-recognition success, but when split into high-low verbal groups no significant association between verbal ability and word-recognition errors was found.

Kagan administered four paragraphs to the same children as second graders and assigned errors to one of 10 categories. The most frequent error scored was an intentional omission. In this case, the child could not decode the word and skipped it. Low verbal children made four times as many of these omissions as did the high verbal child. The second most frequent error was a partial-identity substitution. This type of error is typical of using a word which has partial graphemic similarity to the original. Suffix errors (adding or omitting of suffix) were the third most common error. The remaining error types occurred infrequently.

Intercorrelations among the error types were not uniformly high and some were negative. Those error types thought to be most highly characteristic of impulsive children were partial-identity errors, meaningful and nonmeaningful substitutions, and suffix errors--the last three of which were pooled due to less frequency in occurrence than partial-identity errors. Results showed impulsive children to have higher reading error

scores than reflectives at the end of the second grade. Correlations with MFF errors and reading errors were positive and generally significant. For MFF response time and reading errors, the negative correlations were not as significant.

Kagan (1965b) sums his findings by stating the predicted hypothesis of reflective children being more accurate in reading was confirmed. He goes on to say that

> Response uncertainty should be high when the basic components of reading have been learned but not mastered to the point where multiple hypotheses are not elicited by a new symbol. A preferred disposition for reflection or impulsivity is maximally influential at this intermediate level of mastery (Kagan, 1965b, p. 626).

Reflection-Impulsivity and Learning Disabilities

Little research has been done specifically on R-I as defined by Kagan et al. (1964) and learning disabilities. The intent of this section is to summarize the findings of previous research in these areas and to present related research results in order to build a coherent picture.

Kagan et al. (1964, p. 33) state

> There is growing evidence suggesting that one of the possible consequences of minimal brain damage during the perinatal and early postnatal periods is increased restlessness and distractibility during the preschool and early school years.

In a later study he expands on the effects of brain damage.

> The brain-damaged child, as well as the reading-retarded child, is more prone to be impulsive than reflective and his inferior intellectual performances are more often the result of impulsivity than inadequate verbal or knowledge resources (Kagan, 1966, p. 24).

Of the characteristics (reported in the introduction to Chapter I of this thesis) that were most often noted in LD children, several have

implications to the R-I dimension. Perceptual-motor deficits, hyperactivity, impulsivity, short attention span, and distractibility have been most often studied in relation to R-I, and as reported in Chapter I, it is possible that perceptual defects directly produce these symptoms since most symptoms involve the ability "to receive, hold, scan, and selectively screen out stimuli in a sequential order" (Clements and Peters, 1962, p. 20). This ability is extremely similar to that required on the MFF.

Kagan et al. (1964) hypothesized that impulsivity in decision making is perhaps only a part of a larger syndrome of impulsivity that includes motor activity and short attention span. In his study he found impulsive children to be more frequently involved in gross motor activities than reflectives. He also found that analytic (reflective) boys breathed at a more regular rate than nonanalytic boys. The restlessness, sighing, and lack of attentiveness were considered to be the major causes of respiratory variability. Ward (1968) and Ault et al. (1972) also found impulsives to be less attentive and more hyperactive.

Keeping the above findings in mind and returning specifically to LD children, Clements and Peters (1962, p. 20) state

> Proprioception may be one of the perceptual areas at fault in some of these children, i.e., manifesting as a deficiency in the ability to perceive, discriminate between, and retain images of sequential body movements in space. It may be that there is a deficiency in inhibitory functions having to do with checking and suspending verbal or motor activity until the incoming sensory data are compared with stored information.

This statement attests to the importance of perceptual discrimination and impulsivity in contributing to the symptoms of LD children. According to Keogh (1971) high motor activity could thwart learning by interfering with the intake of information, i.e., the perception of

stimuli. It should be remembered that LD children do not have sensory deficits, but rather perceptual deficits. Sensation refers to the conveying of stimulation into nerve impulses, while perception is the process of interpreting sensation, i.e., to give meaning to sensation through experience. Perception, in its broadest definition, is the capacity for comprehension and is not limited to vision. Lerner (1971) speaks of visual perception, auditory perception, tactile perception, haptic perception, cross-modal perception, and social perception.

The perceptual disorganization of LD children creates a world of inconsistencies and ambiguity. This has implications in the first phase of problem solving discussed in Chapter II of this thesis. A perceptual difficulty does not allow for accurate decoding and comprehension of information.

Keogh and Donlon (1972) studied the perceptual and spatial organization of moderate and severe LD boys with the use of the Portable Rod and Frame Test (PRFT), Pattern Walking Test (PWT), and the MFF. The results indicated no significant difference between severe and moderate LDs on the PRFT or PWT. The severe LDs, however, had significantly more errors and faster response times than moderate LDs. Although the children averaged nine and ten years old for moderate and severe LDs respectively, they performed more like normal seven year olds on the PRFT and like normal seven and eight year olds on the PWT. The performance of the severe LDs on the MFF was similar to normal first graders, while the scores for the moderate group were comparable to normal third graders.

Summary

On the R-I, cognitive style as measured by the MFF, reflectivity and impulsivity are moderately stable over time among school age children. R-I is modified by normal development in that children typically become more reflective with age. There is no consistent difference between males and females in terms of R-I, and the relation of the MFF to intelligence is small for response time and moderate for errors. R-I has been found to extend to similar MFF-like tasks and generalize to less similar ones. Anxiety over error seems to underlie the R-I cognitive style with the reflective child more concerned about the quality of his solution.

Impulsives tend to sustain attention for a shorter period of time and to be more hyperactive than reflectives. Reflectives generally scan the problem situation more systematically than impulsives by looking at more parts, more often, for a longer total time.

Reflective children tend to have a lower number of reading errors than impulsives. The relation between fast decision times and reading errors was higher for high verbal than low verbal children. Reflection positively correlated with word recognition success after one year.

Children with learning disabilities were more impulsive than normal children of the same age. LD children tend to be hyperactive and have attentional problems. Specific learning deficits have been noted along with poor performance on perceptual tasks. It is hypothesized that perceptual disorganization surfaces in the form of characteristic symptoms which interfere with information gathering.

CHAPTER III

METHOD AND PROCEDURE

Subjects

The three groups of Ss were children from four predominately middle-class socioeconomic level public elementary schools in north central Oklahoma. One hundred and five first, third, and fourth graders participated in the research. Children with physical and sensory disabilities were excluded from the study.

First grade developmental readers comprised group I (ages reported in Table I). The children were preliminarily selected from those having scored in the average range of the Metropolitan Readiness Test as kindergartners. The examiner conferred with the teachers as to the children's present reading level in the first grade and discarded those children reading outside of the average range (three months above or below grade level). Thirty-five children were randomly selected from this group and administered the California Short-Form Test of Mental Maturity, s-form level 1. Only those children scoring an IQ of 90 or above were included in the study. The mean IQ for group I was 103 with a range of 90 to 114. The final sample consisted of a total of 31 children (15 males and 16 females).

TABLE I

CHRONOLOGICAL AGES OF MALES AND FEMALES

	Sex	Number	Mean CA	CA Range
First grade non-LD	Male	15	7-1	6-8 to 7-7
	Female	16	7-0	6-7 to 7-7
Third grade non-LD	Male	8	8-10	8-7 to 9-1
	Female	6	8-8	8-6 to 9-1
Fourth grade non-LD	Male	9	9-11	9-6 to 10-10
	Female	10	10-1	9-8 to 10-6
Third grade LD	Male	14	9-0	8-7 to 9-6
	Female	6	9-1	8-7 to 9-8
Fourth grade LD	Male	12	10-2	9-7 to 10-9
	Female	9	10-0	9-6 to 10-6

Group II consisted of third and fourth grade developmental readers (ages reported in Table I). These children were selected as having obtained an average range reading score on the Stanford Achievement Test administered at the end of the second and third grades respectively. Each child's teacher conferred with the examiner as to his/her present reading level, and only those performing within an average range were selected. Forty-four children, 22 third graders and 22 fourth graders were randomly selected from this group and administered the California Short-Form Test of Mental Maturity, s-form level 2. Those children scoring below an IQ of 90 were excluded from the study. The mean IQ for group II was 100 with a range of 90 to 111 (third grade mean 101;

range 93 to 111; and fourth grade mean 99; range 90 to 111). The final sample consisted of 33 children (eight male and six female third graders, and nine male and ten female fourth graders).

Learning disabled third and fourth grade children comprised group III, all of whom were or recently had been attending a learning disability lab for approximately 45 minutes each school day for specialized help in deficit areas. Twenty third graders of 14 males and six females were joined with 21 fourth graders of 12 males and nine females for a total of 41 children. Each of these children had been diagnosed learning disabled on the basis of the Oklahoma State Department of Education regulations and the Clements and Peters' model. The mean Full Scale IQ on the WISC-R for group III was 95 with a range of 80 to 118 (third grade mean 95; range 85 to 117; and fourth grade mean 95; range 80 to 118). Ages of the LD children are reported in Table I.

The reason that an IQ of 90 was selected as the lower cut-off point in group I and II was to study non-LD children conforming to the LD requirement of "normal or potentially normal." The LD children whose Full Scale IQ dropped below 90 are considered to be "potentially normal." The rationale behind this statement is simply that a Full Scale IQ is distorted by strengths and weaknesses. A child with an average Verbal IQ but having visual-motor problems resulting in a low Performance IQ will obtain a Full Scale IQ which is relatively meaningless. In this study, not only did the LD children have the lowest Full Scale IQ, but also the highest. Also they had a Verbal IQ mean of 96 with a range of 77 to 122, and a Performance IQ mean of 94 with a range of 72 to 117.

Instruments

Matching Familiar Figures

Reflection-impulsivity was measured with the Matching Familiar Figures (MFF) test developed by Jerome Kagan et al. (1964). This visual discrimination test presents a familiar object (standard), such as a boat, along with six variants, of which only one is identical to the standard. The test consists of two practice and 12 test items of standards and variants. The standard is located on the top page of the book with the variants on the bottom page. The pages of the book were covered in clear plastic and held by a stand so that the top and bottom pages faced each other at a 120^{o} angle. The child is told to find the picture on the bottom page that is exactly the same as the single picture on the top page and point to it. Praise is extended to the child if the correct variant is selected. If a similar variant is selected the child is told that it is incorrect and asked to select another until the correct variant is found. The major variables scored were the total number of errors and the total response time to first selection across the 12 test items. Figure 1 illustrates a typical test item.

There are no reported national norms for the MFF. Reliability and validity have been reported by various researchers using Kagan's instrument on whatever group participated in their studies. Short term test-retest and equivalent form reliability have produced internal consistency coefficients ranging from .62 to .98 (Messer, 1974).

Convergent validity has been reported in several studies. Response times to the MFF, Design Recall Test and Haptic Visual Matching Test are moderately intercorrelated with coefficients ranging from .33 to

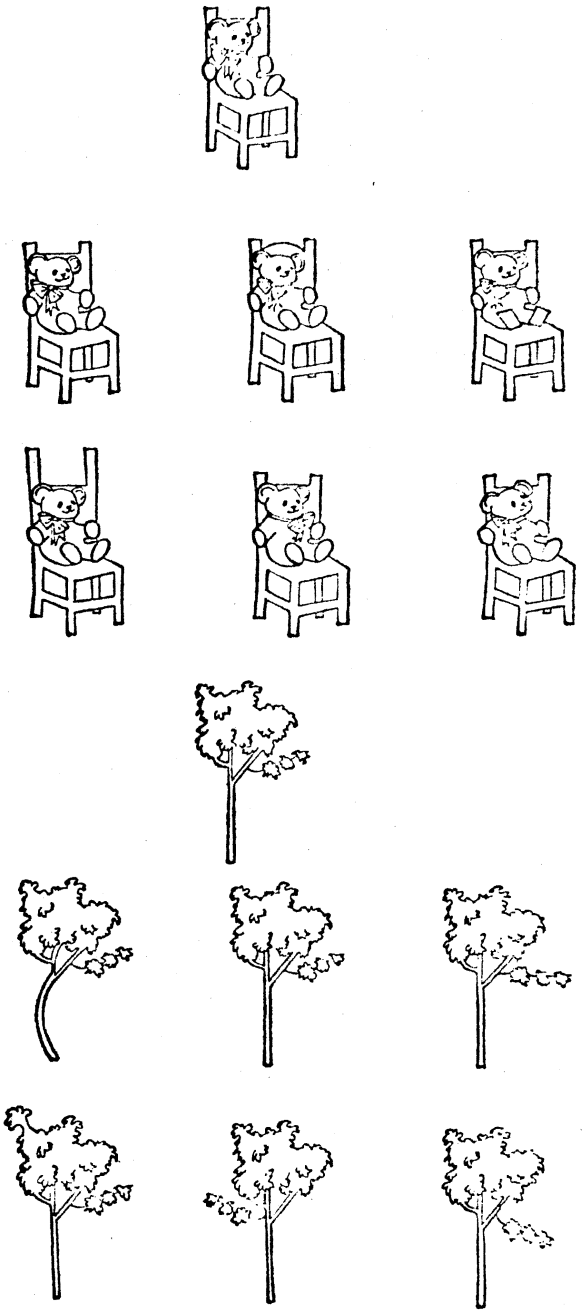


Figure 1. Sample Items from Matching Familiar Figures

.52 (Kagan et al., 1966; Kagan et al., 1964). Denney (1973) found a correlation of .45 between response time on the MFF and response time on a "twenty-questions" type task. Yando and Kagan (1970) constructed ten different MFF tests with different numbers of variants. The median correlation over ten weeks was .73 for response time and .68 for errors.

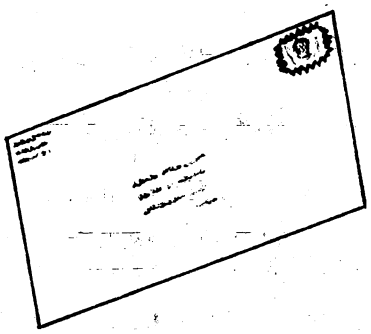
Silent Reading Diagnostic Tests

Reading performance was measured with the first two tests of the Silent Reading Diagnostic Tests by Bond, Balow, and Hoyt (also referred to in this paper as the BBH). Test 1 assesses reading errors made with words in isolation, i.e., words by themselves without benefit of sentence context. The test consists of two practice items and 54 test items in which a picture is displayed with five words next to it. The child is told to find the word that tells about the picture and blacken the circle in front of that word. Figure 2 shows a similar test item. There is only one correct word that describes each picture. The remaining four words are comprised of misspellings and words similar in appearance to the correct word. These four words are scored for specific types of errors.

Test 2 measures words in context. Two practice items and 30 test items identify errors made with words in the context of a sentence. Figure 3 demonstrates similar test items. The child is told to read the sentence and blacken the circle in front of the word that best fits in the blank space. Internal error analysis is identical to Test 1, with correct responses scored along with initial, middle, ending, and orientation errors and those items omitted.

Initial errors are made at the beginning of a word, e.g., "look"

- o invelope
- o envailope
- o envelope
- o lettar
- o envleope



- o pam
- o nap
- o fan
- o pan
- o pin

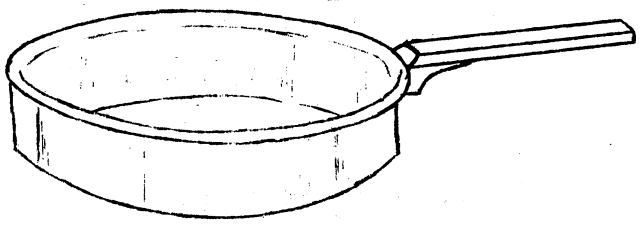


Figure 2. Items Resembling Silent Reading Diagnostic Tests, Test 1: Words in Isolation

The _____ was on the table.

o disk o dich o wish o hisd o dish

He got a drink from the _____.

o fountan o bottel o fountain o class o foumtain

The boy fed hay to the _____.

o cattel o house o horss o horse o kattle

He answered the _____ when it rang.

o tellephone o telephone o television o telpehone o telefone

Figure 3. Items Resembling Silent Reading Diagnostic Tests, Test 2: Words in Context

for "book". A middle error occurs when the selected word has the correct beginning and end but the middle portion is incorrect, e.g. "stir" for "star". When the error is found at the last part of a word an ending error is scored, e.g. "frob" for "frog". The fourth type of error scored is an orientation error. In this case two letters have exchanged places, e.g., "was" for "saw" or "moeny" for "money". Also scored are unmarked and double marked items under the heading of omitted. The total number correct, omitted, and of each error type on Test 1 and 2 were combined for a summation of the variables. Also, since these tests were not being used to find grade levels of performance, the ten minute time limit on each test was discarded and total time for completion was recorded.

The BBH was standardized on a sample of 2,500 children representative of approximately 38,000 children using stratified sampling procedures. Reliability was assessed by use of the split-half technique based on two third grade classrooms' performance. Test 1 has a reported reliability coefficient of .95 with a standard error of measurement of 2.73. Test 2 has a reliability coefficient .93 with 1.60 as the standard error of measurement. The combined score of Test 1 and 2 has a reliability of .97 and standard error of measurement of 3.08.

The authors of the BBH report content validity in terms of a judgmental process based on the following characteristics:

1. The tests are highly relevant to reading instruction because they clarify important required skills.

2. The tests require item responses to situations either actually functional in reading or closely related thereto.

3. The tests are highly analytical and are based upon research evidence of learning difficulties.

4. The tests reveal the mental processes of the learner sufficiently to detect points of error for which remedial procedures are suggested.

5. The tests systematically cover a long sequence of word-recognition skills in detail. (Bond et al., 1970)

Wechsler Intelligence Scale for Children-Revised

Verbal ability for each child was assessed by obtaining an average scaled score for the Information and Vocabulary scales of the Wechsler intelligence test as suggested by Kagan (1965b, 1966). In the present study, the Wechsler Intelligence Scale for Children-Revised (WISC-R) was used rather than its predecessor the WISC. Unlike Kagan's median split of the average scaled scores into high and low verbal ability, the present study used the WISC-R's scaled score mean. Those children scoring an average of 10 or greater were classified as high verbal, while those obtaining an average score less than 10 were classified as low verbal. The rationale for this is twofold. First, the WISC-R's mean scaled score of 10 indicates average ability with scores above and below it considered higher and lower in that ability. Secondly, a median split on a positively or negatively skewed distribution of scores would result in a high-low classification of scores which were predominately low or high, thus distorting the picture as far as average ability is concerned. Basing the criteria for a high-low split in verbal ability on the instrument rather than on the central tendency of a group of scores allows for a clearer representation to be formed.

Procedure

All 105 children were administered the four tests by a school

psychometrist. All testing was done within a five week period at the respective schools during regular school hours.

The California Short-Form Test of Mental Maturity was administered to small groups of six to eight non-learning disabled first, third, and fourth grade children. Those children scoring above the average range were administered Tests 1 and 2 of the Silent Reading Diagnostic Tests in groups of six to eight. The learning disabled children were also administered the two reading tests in small groups of five to eight. The children were told to close their test forms when completed and sit quietly until all had finished. At the point when a child closed the test booklet the elapsed time from beginning the test was recorded. It was necessary to provide the learning disabled and first graders with a drawing task upon completion while others in the group were still engaged with the test. Unlike those in group II who remained relatively still and quiet, group I and III were restless to the point that they would distract others if not occupied with a task. Both reading tests lasted approximately 30 minutes total time.

Each of the children were seen a third time individually for a testing session lasting approximately 15 minutes in which the MFF and the Information and Vocabulary WISC-R subtests were given. None of the children had any difficulty understanding the instructions for the MFF once they completed the practice items. For each of the 12 test items, the examiner recorded the number of errors and time to first response (whether correct or not) for each child.

Administered immediately following the MFF were the Information and Vocabulary subtests. Standard WISC-R instructions and procedures were followed with the scale scores of the two subtests being averaged

for each child. While the learning disabled children had previously been administered the WISC or WISC-R (between six months to three years earlier) their scaled scores were not used. Current performance on the subtests was of importance and, therefore, all children were administered the same tests.

Research Questions

This research attempts to answer the following questions:

1. What are the differences between the groups on the Matching Familiar Figures test? (Questions 1, 3, 5, and 7 examine response time and response errors.)

2. What are the differences between the groups on the Silent Reading Diagnostic Tests: Test 1 (Words in Isolation) and Test 2 (Words in Context) combined on measures? (Questions 2, 4, 6, and 7 examines time, correct, omitted, initial errors, middle errors, ending errors, orientation errors, and total errors.)

3. What are the differences between males and females in each of the three groups on the Matching Familiar Figures test?

4. What are the differences between males and females in each of the three groups on the Silent Reading Diagnostic Tests: Test 1 and 2 combined?

5. What are the differences between high and low verbal ability children in each of the three groups on the Matching Familiar Figures test?

6. What are the differences between high and low verbal ability children in each of the three groups on the Silent Reading Diagnostic Tests: Test 1 and 2 combined?

7. What are the relationships between the measures on the Matching Familiar Figures test and Silent Reading Diagnostic Tests: Test 1 and 2 combined in group III (LDs)?

Analysis of the Data

Questions 1, 2, 3, 4, 5, and 6 were investigated with the use of one way analysis of variance to yield general descriptive information concerning the three groups. Pearson product-moment correlation was used to determine the relationships between the variables in Question 7. A significance level of .05 was selected as the criterion for difference.

CHAPTER IV

RESULTS

Introduction

The purpose of this study was to examine the differences in reading errors and impulsivity between LD and non-LD children, between males and females, and high and low verbal children. In addition, the relationship between reading errors and impulsivity in LDs was investigated. One way analysis of variance was used as the test of difference and Pearson product-moment correlation determined the relationship.

Tests of the Research Questions

Seven research questions will be discussed in terms of the statistical results of the data.

Question 1: What are the differences between the groups on the Matching Familiar Figures test? (Questions 1, 3, 5, and 7 examine response time and response errors.) Table II reports the mean scores for each group, and Table IV presents the F ratio and p value for each variable between paired groups. Differences were found on Question 1 for response time, with groups I and III both being faster than group II. No significant difference was found on response time between groups I and III. Analysis of variance on response errors revealed a significant F ratio between all paired groups on MFF errors with group I

committing more errors than group III and both making more than group II.

TABLE II

MEAN SCORES ON MFF FOR GROUPS I, II, III

	I	II	III
Response Time (min.)	1.89	3.24	1.55
Response Error	15.12	6.93	12.24

Question 2: What are the differences between the groups on the Silent Reading Diagnostic Tests: Test 1 and 2 combined. (Questions 2, 4, 6, and 7 examine time, correct, omitted initial errors, middle errors, ending errors, orientation errors, and total errors.) Table III reports mean scores for each group, and Table IV reports the F ratio and p value for each variable between paired groups. On BBH time, group I significantly differed with both groups II and III, but group II and III did not yield a significant F ratio. Groups II and III averaged 16 minutes in taking the test, and group I took approximately 1.3 times longer to complete the test than the other two groups.

All paired groups were found to differ significantly on total items correct. Group I had the fewest correct and group II the most correct. There were 1.5 more correct items in group III than group I, and 1.6 more correct items in group II than group III.

On the total number of items omitted, differences were found between groups I and II, and I and III, but no differences were found for groups II and III, who omitted an average of .75 items. Group I omitted three times as many items as either group II or III.

TABLE III

MEAN SCORES ON BBH FOR GROUPS I, II, III

	I	II	III
Time (min.)	21.11	14.94	17.29
Correct	27.93	66.54	41.65
Omitted	3.12	0.75	0.75
Initial Error	13.06	4.06	10.34
Middle Error	16.54	2.93	10.92
Ending Error	11.12	4.84	9.41
Orientation Error	12.35	4.00	11.07
Total Error	53.41	15.81	41.75

All paired groups significantly differed on the initial error variable. Group I made 1.3 more initial errors than group III who made 2.5 more than group II.

All paired groups differed significantly on number of middle errors. Group I committed 1.3 times more middle errors than group III and group III made five times more than group II.

TABLE IV

F RATIO AND p VALUE FOR EACH VARIABLE BETWEEN PAIRED GROUPS

	Group I-II (df=1/62)		Group I-III (df=1/70)		Group II-III (df=1/72)	
	F	p	F	p	F	p
BBH						
Time	33.13	.0001	4.87	.03	2.28	NS
Correct	264.75	.0001	27.20	.0001	77.87	.0001
Omitted	10.68	.002	13.30	.001	0.00	NS
Initial Error	106.87	.0001	6.40	.02	44.95	.0001
Middle Error	337.67	.0001	29.89	.0001	75.61	.0001
Ending Error	59.07	.0001	2.95	NS	31.11	.0001
Orientation Error	114.70	.0001	2.67	NS	66.33	.0001
Total Error	248.23	.0001	16.76	.005	96.95	.0001
MFF						
Response Time	18.24	.0002	2.43	NS	62.62	.0001
Response Error	53.54	.0001	8.59	.005	41.92	.0001

The variable of ending errors revealed a significant F ratio between groups I and II, and II and III. No significant differences between groups I and III on number of ending errors were found. Group III made 2.25 more ending errors than group II, and groups I and III averaged 10.25 errors.

Groups I and II, and II and III differed significantly on orientation errors committed. No significant difference was found for groups I and III who averaged 11.71 orientation errors. Group III engaged in 2.75 more such errors than group II, while group I made three times more orientation errors than group II.

Question 3: What are the differences between males and females in each of the three groups on the Matching Familiar Figures test? Table V displays the mean scores and Table VII gives the F ratio and p value for each variable. For MFF response time in group I, males were found to be faster than females. No significant differences were found between groups II and III on MFF response time. No significant differences were found in the three groups on MFF errors indicating males and females performed the same on that variable in each respective group.

Question 4: What are the differences between males and females in each of the three groups on the Silent Reading Diagnostic Tests: Test 1 and 2 combined? The mean scores are found in Table VI and the F ratio and p value for each variable is reported in Table VII. In group I, no difference was found on the variables except middle errors. The males took less time to complete the test, had fewer correct, omitted fewer items, but committed more of each error type except middle errors. No significant differences were found in group II on time, omitted, middle errors, and ending errors. All other variables obtained a

significant F ratio with males having fewer correct and making more initial, orientation, and total errors. For group III, none of the variables reached significance.

TABLE V

MEAN SCORES ON MFF FOR SEX IN GROUPS I, II, III

	I		II		III	
	Male	Female	Male	Female	Male	Female
Response Time (min.)	1.39	2.36	3.09	3.40	1.55	1.56
Response Error	15.73	14.56	7.58	6.25	12.73	11.40

Question 2: What are the differences between high and low verbal ability children in each of the three groups on the Matching Familiar Figures test? Table VIII presents the mean scores and Table X reveals the F ratio and p value for each variable. No significant differences were found on both response time and errors in each of the three groups.

Question 6: What are the differences between high and low verbal ability children in each of the three groups on the Silent Reading Diagnostic Tests: Test 1 and 2 combined? The mean scores are found in Table IX and Table X presents the F ratio and p value for each variable. No differences were found in group I, but differences were found with middle errors in group II and number omitted in group III. Low verbal ability children in group II made more middle errors than their high

verbal counterparts, and high verbal ability children in group III omitted more items than low verbal ability children.

TABLE VI

MEAN SCORES ON BBH FOR SEX IN GROUPS I, II, III

	I		II		III	
	Male	Female	Male	Female	Male	Female
Time (min.)	18.38	23.67	15.11	14.76	16.77	18.19
Correct	23.80	31.81	62.05	71.31	41.23	42.40
Omitted	1.40	4.75	0.94	0.56	0.61	1.00
Initial Error	14.66	11.56	5.11	2.93	11.03	9.13
Middle Error	17.40	15.75	3.52	2.31	10.73	11.26
Ending Error	13.06	9.31	5.29	4.37	9.42	9.40
Orientation Error	13.46	11.31	5.41	2.50	11.34	10.60
Total Error	58.60	48.56	19.29	12.12	42.53	40.40

Question 7: What are the relationships between the measures on the Matching Familiar Figures test and Silent Reading Diagnostic Tests: Test 1 and 2 combined in groups III (LDs)? Table XI reports the intercorrelations between all major variables for group III. Significant correlations were found on several relationships. All error types and total errors on the BBH were negatively related to number correct on the BBH ranging from -.60 to -.98 and significant at the .001 level. Initial

TABLE VII

F RATIO AND p VALUE FOR EACH VARIABLE BETWEEN MALES AND FEMALES IN EACH GROUP

	Group I (df=1/29)		Group II (df=1/31)		Group III (df=1/39)	
	F	p	F	p	F	p
BBH						
Time	10.25	.005	0.10	NS	0.26	NS
Correct	10.79	.005	7.19	.02	0.07	NS
Omitted	7.39	.02	0.39	NS	0.58	NS
Initial Error	4.92	.05	6.11	.02	1.52	NS
Middle Error	1.75	NS	2.34	NS	0.11	NS
Ending Error	8.02	.01	1.42	NS	0.00	NS
Orientation Error	6.98	.02	6.22	.02	0.36	NS
Total Error	9.08	.01	6.73	.02	0.25	NS
MFF						
Response Time	5.13	.03	0.49	NS	0.00	NS
Response Error	0.40	NS	1.01	NS	1.63	NS

errors significantly correlated with middle, orientation, and total errors in a positive direction. Middle errors also positively correlated with ending, orientation, and total errors. Both ending and orientation errors were positively related to total errors at .05, and approached significance with each other. MFF response time negatively correlated with middle, orientation, and total BBH errors at the .05 level, and approached significance with BBH time and number correct in a positive direction. MFF errors were significantly related to MFF response time in an inverse relationship at .05, and approached significance with initial and middle errors in a positive direction. No significant correlations were found for all other possible remaining relationships.

TABLE VIII

MEAN SCORES ON MFF FOR VERBAL ABILITY IN GROUPS I, II, III

	I		II		III	
	High	Low	High	Low	High	Low
Response Time (min.)	2.04	1.46	3.36	3.17	1.65	1.52
Response Error	14.95	15.62	7.23	6.75	11.30	12.54

TABLE IX

MEAN SCORES ON BBH FOR VERBAL ABILITY IN GROUPS I, II, III

	I		II		III	
	High	Low	High	Low	High	Low
Time (min.)	21.78	19,18	14.61	15.61	16.23	17.63
Correct	28.21	27.12	67.92	65.65	45.70	40.35
Omitted	3.39	2.37	0.30	1.05	1.70	0.45
Initial Error	12.73	14.00	3.30	4.55	8.20	11.03
Middle Error	16.52	16.62	1.76	3.70	8.50	11.70
Ending Error	11.04	11.37	5.07	4.70	9.50	9.38
Orientation Error	12.47	12.00	3.53	4.30	10.30	11.32
Total Error	53.26	53.87	13.61	17.25	36.50	43.45

TABLE X

F RATIO AND p VALUE FOR EACH VARIABLE BETWEEN HIGH AND LOW VERBAL ABILITY IN EACH GROUP

	Group I (df=1/29)		Group II (df=1/31)		Group III (df=1/39)	
	F	p	F	p	F	p
BBH						
Time	1.47	NS	0.24	NS	0.20	NS
Correct	0.11	NS	0.34	NS	1.29	NS
Omitted	0.42	NS	1.50	NS	5.48	.03
Initial Error	0.54	NS	1.66	NS	2.76	NS
Middle Error	0.00	NS	6.30	.02	3.53	NS
Ending Error	0.03	NS	0.22	NS	0.00	NS
Orientation Error	0.21	NS	0.34	NS	0.54	NS
Total Error	0.01	NS	1.42	NS	2.22	NS
MFF						
Response Time	1.25	NS	0.18	NS	0.56	NS
Response Error	0.09	NS	0.12	NS	1.12	NS

TABLE XI

INTERCORRELATIONS BETWEEN ALL MAJOR VARIABLES IN GROUP III

	1	2	3	4	5	6	7	8	9	10
BBH										
1. Time		.01	.01	.13	.01	-.15	-.08	-.01	.26	.22
2. Correct			-.08	-.76[c]	-.83[c]	-.60[c]	-.66[c]	-.98[c]	.29	-.21
3. Omitted				.07	-.16	.03	-.06	-.04	-.01	-.12
4. Initial Error					.52[c]	.23	.33[a]	.73[c]	-.13	.26
5. Middle Error						.43[b]	.47[b]	.84[c]	-.32[a]	.28
6. Ending Error							.26	.65[c]	-.14	-.002
7. Orientation Error								.67[c]	-.32[a]	.07
8. Total Error									-.31[a]	.22
MFF										
9. Response Time										-.34[a]
10. Response Error										

[a] $p < .05$, two tailed.

[b] $p < .01$, two tailed.

[c] $p < .001$, two tailed.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary of the Investigation

This study examined impulsivity and reading errors of third and fourth grade learning disabled children with their age-group non-learning disabled peers and non-learning disabled first graders. The relationship between impulsivity and reading errors in LDs was also investigated. First graders were screened with the Metropolitan Readiness Test (as kindergartners) while the third and fourth grade non-LDs were screened with the Stanford Achievement Test (as second and third graders). Children scoring within an average range on their respective tests were further screened with their teachers' observations. Those children who were functioning in reading at an average range were eligible to participate in the study. Random selection from these groups was performed and those being selected were administered the California Short-Form Test of Mental Maturity. Only those children scoring average or above participated in the study.

The LD children were selected by having been previously diagnosed as learning disabled according to state regulations. These children and the non-LD first, third, and fourth graders were administered the Silent Reading Diagnostic Tests: Test 1 and 2 (referred to as BBH) measuring reading words in isolation and context. All children were also administered the Matching Familiar Figures (MFF) test, and the

Information and Vocabulary subtests of the Wechsler Intelligence Scale for Children-Revised (WISC-R). The variables scored on the BBH were time, correct, omitted, initial errors, middle errors, ending errors, orientation errors, and total errors. Response time and errors were recorded on the MFF, and the average scaled score for the two WISC-R subtests was computed.

The final sample consisted of 31 first (group I), and 33 third and fourth grade (group II) developmental readers. Forty-one third and fourth grade LD children comprised the third group. All 105 children were attending elementary schools in north central Oklahoma.

Seven research questions were presented in order to investigate the differences between the groups, between males and females in each group, and between high and low verbal ability in each group on word-recognition and impulsivity. In addition, the intercorrelations between impulsivity and word-recognition was studied in group III (LDs). The raw data was subjected to one way analysis of variance and Pearson product-moment correlation.

The results of this study indicate that group I is highly different from group II on all variables. Groups II and III are also highly different on all variables with the exception of BBH time and number of items omitted on the BBH. Groups I and III were similar on BBH ending and orientation errors, and MFF response time but different on all other variables.

In group I males were found to be different than females on all variables other than BBH middle errors and MFF errors. Males were faster, had fewer items correct on the BBH, omitted fewer items, but committed more of each error type except middle errors. The males of

group II were similar to females on BBH time, number omitted, middle errors, ending errors, and MFF time and errors. Females had more items correct, and fewer initial, orientation, and ending errors. The males and females of group III were similar on all variables.

There were no significant differences between high and low verbal ability children in group I on any variable. High and low verbal ability children were similar in both groups II and III on all variables except middle errors in group II and number omitted in group III. Low verbal ability children in group II made more middle errors, while high verbal children in group III omitted more items.

The intercorrelations between variables in group III indicate several significant relationships between BBH variables, a significant relationship between MFF variables, and a few significant relationships between MFF and BBH variables. Number correct on the BBH was related to the number of each error and total errors. All BBH error types were related to total errors. Orientation errors were related to initial, middle, and ending errors. Middle errors were related to initial and ending errors. MFF response time was related to MFF errors. Time on the BBH did not predict BBH items correct, items omitted, or any error type.

MFF response time was positively related to BBH time, but to a low degree. MFF errors also correlated with initial and middle errors in small positive relationships, and with BBH number correct in a low negative relationship. Number correct on the BBH was related to MFF response time in a low positive relationship. Significant and higher negative relationships were found between MFF response time and middle errors, orientation errors, and total errors.

Conclusions of the Study

Basically, third and fourth grade developmental readers are considerably different from third and fourth grade LD children. The LD children tend to be more impulsive than their counterparts and make more errors in reading and visual discrimination tasks. Of the four word-recognition error types investigated in this study, middle errors comprised the highest ratio of five errors in the LD group for each one made by non-LD peers. While LDs make more of each type error than their non-LD peers, they apparently attended less to the middle portion of a word than the initial or ending parts.

The impulsiveness of LDs on the MFF did not generalize to the BBH. The LDs, while prone to more failure, did not become frustrated and rush through the tests. Indeed, the LDs struck with the task and refused to omit any more items than their non-LD peers.

In general, the first grade children were similar in some aspects but different in others to third and fourth grade LDs. On the MFF, first graders were just as impulsive as the LDs; however, they made more visual discrimination errors than did LDs. Thus, the third and fourth grade LDs were as impulsive as first graders, but more nearly like second graders (Messer, 1974) in number of errors. Apparently the LDs have not slowed down their response time on the MFF, but they have improved their utilization of that time in gaining visual information. On the BBH, however, the first graders were slower than the LDs. The reason for this may be that the first graders grew tired of the test earlier and became distracted from the task more often. This follows the informal observations of the first graders' test taking behavior, but it was not systematically recorded. Another interesting difference

between the two groups occurred on the number of items omitted--three times more for first graders. This appears to be the result of the first graders being distractable and losing their place. It was often observed that when a first grader looked away from the test and then re-established eye contact with the task, that an item or two had been skipped. The LDs, like their non-LD peers, tended to skip an item after unsuccessful deliberation on it.

While first graders tended to commit 1.3 times more initial and middle errors than the LDs, they performed essentially the same with respect to ending and orientation errors. The errors of orientation are of specific interest since normal beginning readers and LDs tend to make related errors of reversing and rotating letters and drawings in reading and writing. The orientation errors of LDs are quite possibly due to perceptual deficits, while those of normal beginning readers are developmental in nature.

The comparisons of males to females in each group provides data congruent with most previous research. At the first grade level males and females tend to be different on most variables including impulsivity on the MFF. By the third and fourth grade, however, there are fewer differences and no difference in impulsivity. No differences on any variable between males and females in the LD group was found. This tends to indicate that the effect of the underlying cause to their problems equalizes at the third and fourth grade level.

As a whole, no significant differences were found between high and low verbal ability children in the three groups except middle error (group II) and items omitted (group III). These results are not supportive of previous research indicating differences in verbal ability

and word-recognition success, but do support the finding that when split into high-low verbal ability groups there is no significant relationship between verbal ability and word-recognition errors.

The significant negative relationship in the LD group between MFF response time and MFF errors is consistent with previous research indicating that more errors are made on a visual discrimination task as decision time decreases. This relationship was not found between BBH time and BBH errors. MFF response time did predict (negatively) middle, orientation, and total errors on the BBH, and positively predicted BBH time and number correct but less significantly. The impulsivity on the MFF apparently predicts certain error types. As mentioned earlier, LDs commit more middle errors than their non-LD peers, and their impulsivity on the MFF may indicate less attending time devoted to this portion of a word. Likewise, orientation errors may occur more often because of less attention to the visual order of letters.

The phases of problem solving were mentioned in Chapter II. Impulsives tend to have difficulty with phases two and four in which the hypothesis is formed and the solution evaluated. Since LD children tend to have perceptual deficits, then phase one concerning the decoding and comprehension of the problem situation could be affected. LD children, it should be remembered, tend to be impulsive. It follows, therefore, that LDs will have difficulty with phase one, two, and four of the problem solving sequence. They would have considerably more problems with word-recognition due to difficulty in decoding and comprehending the word parts, forming a hypothesis as to its pronounciation, and evaluating the solution before saying the word.

Recommendations

Reflective delay in evaluating one's cognitive products is likely to be important in determining the quality of solutions. The tendency to ignore the relevance of individual differences in the processing of information, i.e., the selection of and reflection on information, has slowly begun to reverse in recent years within the schools. The major implication of this study is to emphasize the importance of a specific cognitive style (reflection-impulsivity) on cognitive products. Some children respond quickly and discover later whether they were correct. Other children reflect before responding so as to eliminate incorrect answers.

The child who has anxiety concerning his ability and expects to fail may believe that silence will be seen as incompetence in producing the correct answer immediately. To relieve the tension a response is offered impulsively. The anxiety resulting from repeated failure due to impulsive responding could possibly produce generalized expectations of failure leading to a withdrawal from intellectual involvement. This can be seen in LD children whose dysfunction disrupts the ability to comprehend some information, thus leading to an inadequate base upon which to develop a solution producing repeated failure. After years of a dysfunction-failure sequence it should not be too surprising to find that LD children are considerably impulsive. The sooner the child produces an answer, whether correct or not, the sooner will tension dissipate and the teacher go on to the next child. The silence accompanying the reflection on a problem situation should be easier to tolerate if the child expects success.

Consideration should be given to training LD children in

reflection as a habit, independent of specific material content. However, modifying response time toward reflection may not drastically improve the situation since the dysfunctions will remain. The teacher should encourage delaying responses but at the same time train the child to use visual, verbal, and tactile cues in discriminating the problem parts. This would allow for improved decoding and comprehension of the situation, and increased ability to form solutions and evaluate them before responding.

Some of the results tend to give support to the maturational lag theory by indicating that as LD children grow older, their deficit areas improve. The LDs had more correct reading items than first graders, but fewer than non-LD peers. Future research should include a developmental history of LD children specifically designed to investigate the possibility of slow maturation of language and motor skills. Such children should be compared with those children of known or highly suspected brain damage resulting from birth.

Systematic behavioral categories of test taking behaviors should be explored in future research. This may further support the impulsivity findings and answer questions concerning omitted items.

Orientation errors in LDs should be investigated. Specifically, LD children with strictly performance deficits should be compared with LDs with strictly verbal deficits on measures of reading, impulsivity, and visual discrimination tasks.

Studies designed to compare impulsivity in young LDs with their peers and to determine changes in LDs through the school years on measures of academics, impulsivity, hyperactivity, and visual discrimination should be undertaken.

Future research should investigate the feasibility of modifying response time in LD children toward a more reflective attitude. In addition, reflection could be taught along with the training of discrimination skills.

The visual scanning strategy of LD children should receive attention with the use of eye cameras and focussing equipment. This could be done with the MFF and with measures of reading, e.g., the BBH.

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