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A DISSERTATION

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LINDA KORDIS WAGNER

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BEHAVIORAL RIGIDITY OF NORMAL AND LEARNING DISABLED
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STANDARD PROGRESSIVE MATRICES

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CHAPTER I

INTRODUCTION

Statement of the Problem

Although considerable work has been reported on the phenomena of behavioral rigidity, a scarcity of research exists on perseveration and rigid behavior in children with learning disabilities. The emphasis has been upon the characteristics and defects of the learning disabled child, without the confirmation of empirical observations.

> There are a number of problems associated with an attempt to evaluate what is fact and what is fancy in this area. One of the problems is the paucity of research studies. There are great gaps in our knowledge as many studies that should have been done haven't been done; much less have there been attempts at replication. There is simply not enough data....
>
> In sum, the most popular stereotypes of learning disabilities have not received empirical support. As of now, and perhaps this will change, there is no systematically gathered evidence demonstrating that learning disabled children have simple perceptual problems, hyperactivity, difficulty with simple cross-modal interaction, minimal brain damage or normal intelligence. (Bryan, 1974, pp. 48, 50)

This study attempted to gain empirical evidence in support of one of the most popular stereotypes of behavior in children with learning disabilities, i.e., rigidity of behavior.

The question was asked: Do children with learning disabilities tend to display more rigid behavior than the normal population of children? The main purpose of this study was to determine whether sixth-, seventh-, and eighth-grade students diagnosed as having learning disabilities differ from normal students in rigidity of behavior, as measured by a modified version of the Wechsler Intelligence Scale for Children-Revised, Coding B subtest, and by Raven's Standard Progressive Matrices. In addition, the relationship between each of the scores obtained from the two measures of behavioral rigidity was investigated.

Analysis of Related Studies

Throughout the years, rigidity was a reoccurring theme in clinical and experimental work. The term acquired a number of definitions that described a range of behaviors: the inability to change habits, sets, attitudes and discriminations; a kind of maladaptive, repetitive behavior. The concept, "rigidity", stemmed from related work in the areas of perseveration and the analysis of personality characteristics. Earlier literature that reported investigations of rigidity viewed it as a neurologically determined peculiarity of individual perception.

Neisser (1894), in an article unavailable to this author but cited by others (Chown, 1959; Levine, A. S., 1955), was the first to introduce the term "perseveration". Perseveration, as originally conceived, referred to a continuation of neural and mental processes. This persistence of processes implied the capacity for establishment and maintenance of set. Perseveration accounted for beneficial effects, such as making for consistency and stability in the individual. However, strong perseveration interfered with rapid adaptation to environmental stimuli and accounted for difficulty in readily shifting attention or set.

Spearman, in 1927, introduced the mental law of inertia which suggested that cognitive processes always began and ceased more gradually than their apparent causes. Perseveration or *p* factor was the amount of "mental inertia" encountered by the "mental energy" or *g* factor.

Pinard (1932) found a connection between tests of perseveration and estimates of mental stability. He reported that mental stability was favored by a medium degree of perseveration rather than either low degrees or high degrees of perseveration.

As a result of the analysis of scores obtained on instruments designed as p-tests (Darroch, 1938; Cattell, 1946a; Walker, Staines, & Kenna, 1934), perseveration was redefined in terms of rigidity. In 1935, Cattell (1935a) distinguished between "the inertia of mental processes", and "dispositional rigidity". The former was a function of alternating between two previously practiced motor skills. The latter occurred when a familiar task had to be performed in some new way.

The work of Strauss and his associates (Strauss & Kephart, 1955; Strauss & Lehtinen, 1947; Strauss & Werner, 1942a, 1942b), described children who exhibited the tendency to perseverate, to be hyperactive, and to function with a rigid, stereotyped kind of behavior. These characteristics had been observed in children who were mentally defective due to damage to the brain. Brain-injury was verifiable through evidence of damage to the central nervous system. The same behavior was also noted in mentally retarded children who showed no signs of neuropathology.

> Historically, early workers associated the disorganized and unpredictable behavior of certain mentally retarded children with similar behavior observed in adult soldiers who sustained brain injuries. The mental retardation and disorganized behavior in the adults was presumed to be caused by the defect in the brain resulting from the wound. Similar behavior in mentally retarded children, even though there was neither clinical nor developmental historical evidence of injury to the brain, was thought to be sufficient reason for attributing the etiology of the retardation to a defective brain. The presence of disordered behavior in individuals without diagnosable lesions made it possible to make an etiological classification on the basis of an inferential diagnosis. (Stevens & Birch, 1956-1957, p. 347)

Strauss employed the term "brain-injured" to explain the basis for disorders of mentality, behavior, and learning characteristics of this population of children. "This was an oversimplification with serious and far-reaching consequences" (Stevens & Birch, 1956-1957, p. 347).

This group of perseverating, behaviorally rigid children was the topic of Strauss' book (1947), Psychopathology and Education of the Brain-Injured Child. It was the first comprehensive presentation on the topic of brain dysfunction in children. It marked the beginning of learning disabilities as a field of study in America (Lerner, 1971).

Since 1947, when Strauss introduced this new category of exceptional child, a new area of special education has evolved. Learning disabilities has become a field with its own methodology, jargon, institutional support and structure. However, the pace with which this occurred created problems (Doll, 1956; Klatskin, McNamara, Shaffer, & Pincus, 1972) which were best summarized by Bryan (1974):

> The rapid development and expansion of the field has resulted in many early clinical observations being repeated and endorsed so often and disseminated so widely that they became accepted as fact by practitioners before they could be empirically evaluated. (p. 47)

Children with learning disabilities have typically been described as exhibiting perseverating tendencies and rigid behavior. The data supporting this observation was minimal. The present study was an effort to empirically evaluate the merit of such a statement.

The observation of such behavior in brain injured persons led to several theories of rigidity. The major theories of behavioral rigidity were proposed by Goldstein (1943), Lewin (1935, 1936), and Werner (1940, 1946a, 1946b). Goldstein (1943) viewed rigidity from a neuropathological standpoint; Werner (1940, 1946a, 1946b) employed a comparative-developmental orientation to the problem; and Lewin (1935, 1936) approached rigidity as a topological construct.

Goldstein (1943) recognized the role of rigidity in normal behavior. However, he was particularly interested in its more pathological manifestation. Goldstein observed that increased rigidity was related to an "isolation of systems" (Goldstein, 1943, p. 209), i.e., some part of the central nervous system was separated from the rest of the system either anatomically or functionally, or one mental performance functioned separately from other performances.

> The patient behaves in the same way in all performances. If something is presented as a part of the activity he is engaged in at the moment, and if it can be included in the perceptual process in spatial and temporal continuity, then he becomes conscious of it. Everything which is not related to the patient's task at hand either does not affect him at all, or only acts as a disturbing stimulus. (Goldstein, 1943, p. 211)

Goldstein considered secondary rigidity a result of a defect in the higher mental processes. He depicted the person experiencing secondary rigidity as one who was able to handle concrete situations, but when presented with situations which require the ability to abstract, responded rigidly to the part of the task which he could perform. Secondary rigidity was characterized as an impairment of the abstract attitude which compelled the individual to behave concretely. For this type of person, conditions which demanded the ability to think abstractly were catastrophic because he was not able to cope with them. Goldstein interpreted rigid behavior in response to catastrophic situations as one means of escaping distress.

Goldstein approached rigidity from a neuropathological standpoint. He distinguished between primary and secondary rigidity. They were considered to have different causes and their effects on the individual were dissimilar.

In contrast to Goldstein, Werner (1940, 1946a) adhered to a more developmental approach to rigidity. Werner, like Goldstein, recognized rigidity as a normal trait. However, Werner considered it a normal characteristic of less developed organisms. He noted that organisms placed progressively closer to the bottom of the phylogenetic or ontogenetic scale displayed increasingly more rigid behavior. Furthermore, Werner observed, lower species on the evolutionary scale, e.g., primitive man or young children, are more rigid than higher species such as civilized modern man or adults. He pointed out the fact that higher levels of development allowed the species to distinguish between itself and the world, to differentiate, and to form hierarchies.

According to Werner, rigidity was related to inability to engage in abstract thinking. He maintained that less developed organisms were limited in their conceptual activity. These organisms were characterized by Werner as concrete in their thinking. He suggested that this narrowed their range of alternative responses and caused more rigid behavior.

Werner hypothesized two kinds of rigidity "which vary in quantity and quality with organismic conditions" (Werner, 1946b, p. 48): "subnormal" and "abnormal" rigidity. Abnormal rigidity was associated with primitive people and feeble-mindedness of the endogeneous or familial variety. Subnormal rigidity was believed to result from the lack of sufficient differentiation, i.e., "de-differentiation". According to Werner, "situations which do not distinctly differ from one another tend to fuse bringing about global, stereotyped behavior" (Werner, 1946b, p. 50). Abnormal rigidity was characteristic of feeble-mindedness caused by injury to the brain, i.e., of the exogeneous type of mental deficiency. Werner described this type of rigidity in terms of a process of disintegration or isolation by which wholes were dissected into unrelated parts.

Werner (1940, 1946a, 1946b) adopted a comparative-developmental approach to rigidity theory. He viewed rigid behavior as normal in younger, less developed children and primitive man. A distinction was made between abnormal and subnormal rigidity. These two types of rigidity were thought to vary in quantity and quality and to result from differing causes.

The major proponents of rigidity as a topological construct were Lewin (1935, 1936) and Kounin (1941a, 1941b, 1943). Originally, topology referred to "a branch of mathematics that investigates the properties of a geometric configuration that are unaltered if the configuration is subjected to any one-to-one continuous transformation" (Gove, 1967, p. 241).

Lewin (1936) proposed a topological model for the description of psychological phenomena. He employed topological psychology to describe individual behavior in terms of topological relations within the physical and psychological environment of the person which he called "life space". According to the principles of topological psychology, life space was the entire set of phenomena which constituted the reality of a person and determined his behavior. An individual's life space was composed of a number of regions: "objects (including persons), goals, and instrumentalities that affect his behavior at that moment, intra-organismic factors such as needs or motives, abilities, habits are also included" (English, H. B., & English A. C., 1958, p. 295). These regions were the basis of the psychical systems which formed the psychical structure of the total being.

Rigidity was defined by Lewin and Kounin as a function of psychological boundaries. In his book on topological psychology (1936), Lewin commented: "boundaries (barriers, walls) are the more rigid the greater the forces necessary to overcome them" (p. 218).

Lewin and Kounin differentiated between "topological rigidity" and "behavioral rigidity". Topological rigidity was viewed as the property of personality structures which caused actual rigidity or the overt manifestation of rigidity, i.e., behavioral rigidity. They felt topological rigidity could be ascertained only indirectly as it was inferred from behavioral rigidity (Kounin, 1943). Behavioral rigidity was the genotype. In other words, topological rigidity was supposed to be the sum of the causes of the actual phenomena--rigidity.

Lewin asserted that the material properties of a normal young child's psychical system were relatively undifferentiated and mobile. He assumed a progressive stiffening of these material properties with age. The hardening of the psychical systems had the effect of reducing the person's capacity for dynamic rearrangement. Lewin concluded this resulted in lack of mobility, inelasticity and increased topological rigidity with age (Lewin, 1935). Kounin concluded that topological rigidity "is a positive monotonous function of chronological age" (p. 270).

Kounin (1941a, 1941b, 1943, 1948) maintained that an inverse relationship existed between topological rigidity and behavioral rigidity. He proposed that topological rigidity tended to increase with age, while behavioral rigidity tended to decrease with age. Kounin theorized that reduction in behavioral rigidity was associated with degree of differentiation.

Lewin assumed the various psychical regions and systems of normal young children were relatively undifferentiated in comparison to older, more developed persons (1935). Indeed, Kounin (1943) discussed, at great length, the fact that with increased age the total organism experienced greater differentiation, e.g., an adult definitely has a larger and more varied behavioral repertory than a child. The proposed effect of increased stratification of the psychical structure was a decrease in behavioral rigidity with age.

Differentiation was a key element in Lewin's theory of rigidity. The Lewin-Kounin theory considered topological rigidity a genotypical construct which could be one cause of behavioral rigidity. However, they thought topological rigidity could have consequences, other than behavioral rigidity, which they believed were related to differentiation. Lewin (1935) said "one might consider reconstructing the theory so as to place at the center lack of differentiation rather than material properties" (p. 228). One of the reasons for its importance was its assumed relation to topological rigidity. In normal development, Lewin hypothesized, greater differentiation not only decreased behavioral rigidity, but helped off-set the effects of increasing topological rigidity.

> Even though the actual material properties do not change, or, indeed, though the change with age is in the direction of greater topological rigidity, yet a sufficiently faster advance of differentiation should increase the wealth of possible varieties of behavior. (Lewin, 1935, p. 235)

According to Lewin (1935), there existed a "functional equivalence" (p. 232), between greater topological rigidity and greater wholeness [less differentiation] of the total system. Lewin believed both topological rigidity and slight differentiation favored the origin of strong _Gestalten_, which hindered further development and reorganization of _Gestalten_. He emphasized that a restructuring of the field was necessary for intellectual insights. Slighter mobility of psychical systems and greater difficulty in developing and changing _Gestalten_ were posited to result in concreteness and primitiveness of thought and action which was characteristic of young normal children. Lewin not only interpreted the concreteness and primitiveness of young children from this framework, but viewed intellectual growth as a function of the interrelationships of behavioral rigidity, degree of differentiation, and topological rigidity.

> The functional equivalence between greater material [topological] rigidity of the systems and a greater wholeness of the total system in respect to (1) the formation of strong, relatively undifferentiated Gestalten (systems), and (2) the secondary mobility of behavior [less behavioral rigidity] is one of the major causes of the normal child's increase in intellectual achievement with age. This occurs without increase in fluidity of the psychical systems, but rather despite a more probably gradual stiffening. (Lewin, 1935, p. 235)

While high topological rigidity was recognized by Lewin as a cause of behavioral rigidity, he did not consider it the sole cause in every situation. "Certainly the cause of behavioral rigidity may vary" (Lewin, 1935, p. 236). He concluded that behavioral rigidity could result from factors other than topological rigidity and a general lack of differentiation. From Dembo's work on anger (1931), Lewin deduced that increased tension sometimes led to a greater momentary unity and primitiveness of total behavior.

Kounin (1941a, 1943) listed three causes of behavioral rigidity: (a) the general degree of differentiation of the person; (b) the degree of differentiation of relevant areas, and (c) the security of a person in a particular situation. He viewed the person as being differentiated as a whole in regard to such variables as total knowledge, skills, and interests. Kounin thought a person with a small behavior repertory was less differentiated as a whole and would react in a stereotyped manner as he repeatedly tried to employ means that he already knew in a variety of situations. This was Kounin's explanation of how general degree of differentiation of a person was one cause of rigid behavior. A second cause of behavioral rigidity, according to Kounin, was based on the premise that it was possible to refer to the person's degree of differentiation in specific areas such as having a knowledge of mathematics, or an interest in art. Although the person may be highly differentiated as a whole, Kounin suggested he may behave more rigidly in a particular instance because the relevant regions were less differentiated in his case. The third cause of behavioral rigidity involved psychological factors related to the security of a person in a particular situation. These included: fear of failure, uncertainty as to consequences, and hesitancy to enter unfamiliar situations.

Kounin and Lewin viewed behavioral rigidity in relation to specific characteristics of structure, and topological rigidity in relation to definite material properties. The complexity of the theory was enhanced by the hypothesized inverse relationship along the age gradient between topological rigidity and behavioral rigidity. Kounin and Lewin concluded that topological rigidity had other effects than behavioral rigidity and that behavioral rigidity had causes other than topological rigidity. This statement led to much confusion. Failure to clarify and define terms explicitly caused misinterpretation of these aspects of their theory and created controversy among the rigidity theorists.

Werner (1946b) and Goldstein (1943) both criticized the Lewin-Kounin theory of rigidity. Their major criticism of the Lewin-Kounin theory was the apparent contradiction between the hypothesis that (topological) rigidity increased with age and (behavioral) rigidity decreased with age. Both Goldstein and Werner hypothesized that behavioral rigidity decreased with age and argued that the hypothesis, (topological) rigidity increased with age, was "erroneous" (Werner, 1946b, p. 46).

This criticism, and others, that were made by Werner and Goldstein resulted from their failure to recognize topological rigidity and behavioral rigidity as two separate identities. The confusion stems from the fact that there were numerous synonyms used by Lewin and Kounin to mean topological rigidity and several other synonyms meaning behavioral rigidity. However, Lewin and Kounin failed to clearly specify which terms were meant for behavioral rigidity. There were other times when they used the unmodified term "rigidity", which added to the confusion. Much of the controversy which surrounded the Lewin-Kounin theory of rigidity evolved from misunderstandings of a semantic nature (Leach, 1967; Luchins, 1959).

Although a great deal of controversy surrounded rigidity theory, there were some themes common to the three theories. Goldstein, Lewin and Werner all accepted rigid behavior as one aspect of normal development. Each of the men applied the concept of rigidity to a theory of feeble-mindedness. Differentiation was a major concept in all the theories of rigidity.

Goldstein, Lewin and Werner accepted rigid behavior as one aspect in the normal development of the young child. Lewin (1935) spoke of the great behavioral rigidity of the "normal young child" (p. 236). Werner (1946a) reported: "Rigidity...has been observed as a normal trait of less developed organisms" (p. 15). According to Goldstein (1943), rigidity "also plays a great role in normal behavior" (p. 209).

Each of these men applied the concept of rigidity to a theory of feeble-mindedness. For Lewin and Kounin, topological rigidity was the causal factor in mental retardation. Lewin (1935) described the feeble-minded child as "dynamically topologically more rigid, less mobile" (p. 210) than the normal child. Kounin (1941a, 1948) hypothesized that topological rigidity was a positive monotonous function of the degree of feeble-mindedness. Goldstein (1943) on the other hand, believed rigidity was caused by mental deficiency. "Rigidity in feeble-minded children is a consequence of a mental deficiency, especially of the impairment of abstract attitude" (p. 225). For Werner, the essential characteristics of feeble-mindedness was lack of differentiation or isolation of functions as manifested in subnormal rigidity and abnormal rigidity (Werner, 1946a).

Differentiation was a major concept in all three theories. They were in agreement that one of the basic differences between adult and child was the degree of differentiation, the child being less differentiated than the adult. Goldstein (1943) wrote:

> Development, in general, means differentiation from a more uniform behavior of the whole organism to a behavior where the functions of the parts of the organism are represented in an increasingly more complicated organized pattern. (p. 221)

For Lewin, one of the most fundamental dynamic differences between small child and adult was "the degree of differentiation in their various psychical regions and systems" (p. 206). Werner (1940) called increased differentiation and hierarchic integration "the fundamental law of development" and stated that there "seems to be a higher differentiation of function among higher vertebrates" (p. 44).

All three theories asserted lack of differentiation was a cause of behavioral rigidity. Goldstein (1943) believed rigidity was due to abnormal concreteness, which he considered to be one manifestation of the "defect of the higher mental processes" (p. 223). He maintained that this defect of the higher mental processes was "mainly an impairment of the abstract attitude" (p. 213), i.e., "the lack of differentiation" (p. 224). Werner (1946b) agreed that "lack of differentiation... can therefore be considered as the basis of the rigidity" (p. 48). Lewin (1935) thought that lack of differentiation was one cause of behavioral rigidity. Kounin (1941a, 1943) listed two of these factors as general degree of differentiation of the person, and the degree of differentiation of relevant areas.

Degree of differentiation was not only a cause of behavioral rigidity, but all three theories associated smaller degrees of differentiation with concreteness and primitiveness of thinking. "Indeed the tendency to concretness and primitiveness appears to be a general feature of the childlike or otherwise undifferentiated person" (Lewin, 1935, pp. 222-223). Goldstein (1943) said "impairment of the abstract attitude, i.e., lack of differentiation compels the individual to behave more concretely" (p. 213). Werner (1940) noted: "Among primitive peoples, and also children, there is found a kind of thinking which, with great justification, may be termed 'concrete' thinking" (p. 52).

All three theories addressed themselves to the problem of distractibility. Goldstein viewed abnormal distractibility as a function of abnormal rigidity. Both behavioral rigidity and distractibility were considered by Goldstein to be a means of escape from a frustrating situation, i.e., situations which required the ability to abstract. Goldstein theorized that this type of catastrophic situation would be experienced by persons suffering from secondary rigidity.

> Therefore he reacts to that part of the task with which he is able to cope with his remaining capacity and sticks to that in a rigid way....Then he gives us this reaction, I think because continuing it does not help him in overcoming the distress. He tries again and may now become attached to another part of the situation to which he is able to react, and again may feel that he is not performing quite correctly. Thus, he is shifted passively from one situational part to another, to all those with which he can cope. (Goldstein, 1943, p. 215)

So, abnormal rigidity and increased distractibility were both considered, by Goldstein, to be a consequence of a defect in the higher mental processes which he believed affected the ability to think abstractly. Werner (1946b) believed distractibility was encountered mainly in the abnormal form of rigidity found in the brain-injured type of feeble-minded. Lewin (1935) accounted for the extreme sensitivity of the feeble-minded to distractions by their tendency to be "either in the one or in the other situation" (p. 216). According to the Lewin-Kounin theory, the feeble-minded person had high topological rigidity, and tended to establish strong Gestalten. As a result, even a small change in the situation subsequent to external stimuli constituted a much more profound interference. "For in these persons the changed situation must, in much higher degree, tend to appear completesly closed, supplanting entirely the facts of the first situation" (p. 217). So, distractibility was accounted for in all three theories. However, each theorist interpreted it somewhat differently.

Three theories of behavioral rigidity were reviewed. It was noted that there were several points about which there was agreement among the theorists. Semantics and ambiguity in definitions of rigidity were the major sources of the controversy surrounding rigidity theory. The main difference was that Goldstein and Werner thought of rigidity as a description of behavior for which further explanation was necessary while Lewin considered topological rigidity as an explanation in itself. The network of similarities and contrasts in the three approaches to rigidity which have been discussed were best summarized by Luchins (1959):

> For both Goldstein and Werner rigidity refers to certain observable facts of behavior for which they offer explanations. The concept of topological rigidity, as used by Lewin and Kounin, does not refer directly to observable facts or to any act of behavior....The Lewinian construct of rigidity is used to account for some behavior classified as rigidity as well as for other behavior. Thus, rigidity for Goldstein and Werner is an observable fact for which explanations are needed, whereas topological rigidity for Lewin and Kounin is an explanation for certain observable facts.
>
> Some of the observed facts to which the Lewinian construct of rigidity is applied as an explanatory concept are identical with or similar to facts to which such concepts as impairment of the abstract attitude and relative lack of differentiation are applied by Goldstein and Werner, respectively. (pp. 73, 74)

These three theories of rigidity evolved from attempts to relate rigidity to a neuro-physiological defect in the organism. Lewin, Kounin, and Werner particularly emphasized this aspect of rigidity. Goldstein found that a neuro-physiological explanation of rigidity was lacking. In an attempt to reconcile the fact that the degree and site of damage to the brain in his neurological patients did not completely account for rigidity, he began to explore the relationship between personality and perception as a whole.

The work of Lewin, Werner, and Goldstein suggested rigidity was an adaptive measure employed by the organism to cope with situations it could not handle. S. Fisher (1950, 1951) explored this aspect of rigidity further.

He studied rigidity as a defense mechanism. He concluded that the defensive purpose of rigid behavior was to protect the ego from damage when it was threatened. Rigidity as a defense mechanism became the link between perceptual and social rigidity.

A large body of research in the 1950's explored the relationship between perceptual and social rigidity (Adorns, Frenkel-Brunswik, Levinson, & Sanford, 1950; Block & Block, 1951; Fisher, J., 1951; Frenkel-Brunswik, 1948a, 1948b, 1949; Kutner, 1951; Levitt, 1953; Levitt & Zelen, 1953). Issues such as the authoritarian personality, ethnocentricity, and prejudice were raised. Questions about the effects of rigidity on attitudes and practices in child rearing were explored (Baldwin, 1948; Gough, Harris & Martin, 1950; Kates & Diab, 1955; Radke, 1946; Willis, 1956).

Research in the field of social rigidity continued into the 1960's. Much of the recent work was concerned with combating ethnic prejudice and teaching people to consider social issues for themselves (Banton, 1962; Bibby, 1959; Leach, 1964). Work in the field of intellectual and perceptual rigidity emphasized teaching methods in school and how to foster flexible thinking (Ausubel & Fitzgerald, 1961; Ervin, 1960; Ferris, 1962; Gagné & Smith, 1962; Gallagher, 1964a, 1964b; Myers, R. E., & Torrence, 1961; Pringle & McKenzie, 1965).

The concept "rigidity", as reported in the literature, experienced three main stages in its development. Rigidity was studied (a) as a neurologically determined peculiarity of perception which led to perseveration and premature closure; (b) as a type of perceptual defense against ego-involving stimuli; and (c) as a manifestation of personality variables which can be observed in cognitive and social fields, as well as in perception (Leach, 1967). The literature in these three areas was reviewed and provides a background and rationale for this study. The literature which directly pertained to the variables and instruments employed in this study are reviewed below.

Investigations on rigidity in children and adolescents were limited. Braen (1960) and Braen and Wallen (1960) measured rigidity in high school and college students. These studies assessed the reliability of several instruments and compared the performance of college students with high school students on these measures of rigidity. Results of these studies showed that high school subjects were significantly lower in manifest rigidity than college students. No significant sex differences were found on either measure for the high school group. Positive relationships between scores on the two rigidity inventories and those on the intelligence test were found. These results were in direct contrast with those for the college sample. Zborower (1968) investigated the incidence and degree of dogmatism, and rigidity, in students aged 13-17. He reported a decrease in dogmatism scores for adolescents. However, no consistent patterns of descent or ascent with age were found for rigidity scores. Esbenshade (1960) studied rigidity as a function of age and intelligence in women. Subjects were divided into two levels of age, 19-25 yrs. and 64-82 yrs. The two levels (dull, bright) of intelligence were based on Raven's Progressive Matrices Test. Each subject was given three tasks to measure rigidity: Luchins' Einstellung Test, a level of aspiration task involving crossing out r's, and the Wisconsin Card Sorting Test. Esbenshade concluded that dull people were significantly more rigid than bright people, rigidity was not significantly related to age; and rigidity was a specific, rather than a general, personality factor.

One type of child considered to have a learning disability was studied by Burleigh, Gupta, and Satterfield (1971). A group of 32 hyperkinetic and 25 non-hyperkinetic children were sampled. The Porteus Maze Test was used to measure perseveration. The hypothesis that hyperkinetic children perseverate by repeating, in a problem-solving task, an appropriate behavior pattern more frequently than other children was accepted.

No other investigations of children with learning disabilities were found. Several studies of brain-damaged adults and older normal adults employed instruments to measure rigidity which were relevant to this study. Rigidity of brain-injured adults was investigated by Mackie (1963), and Mackie and Beck (1963). Mackie (1963) administered the Wechsler Adult Intelligence Scale, five perception tests, and Schaie's Test of Behavioral Rigidity to 29 brain-damaged patients. Patients with cerebral tissue damage evidenced intellectual and perceptual deterioration, as well as increased behavioral rigidity. Mackie and Beck (1963) confirmed this finding with brain-damaged and normal adult males aged 55-79. Storck, Looft, and Hooper (1972) showed that performance on Raven's Progressive Matrices Test was positively related to the Motor-Cognitive (.49), Psycho-motor Speed (.52), and Composite scores (.59) of Schaie's Test of Behavioral Rigidity in mature and aged adults. Urmer, Morris, and Wendland (1960) compared two groups on the Wechsler Adult Intelligence Scale and Raven's Progressive Matrices. One group was a control group and the other group was diagnosed as having a cerebro-vascular accident. The brain-damaged subjects performed qualitatively and quantitatively pooerer than the control group. The hypothesis that Raven's

Progressive Matrices was sensitive to brain-damage was substantiated. Klatskin, McNamara, Schaffer and Pincus (1972) found that subjects 7 to 12 years of age who were identified as minimally brain damaged did less well on the Wechsler Adult Intelligence Scale coding subtest than other subjects.

A review of related literature showed the lack of empirical evidence pertaining to behavioral rigidity in children with learning disabilities. Most of the studies investigated rigid behavior in brain-damaged, mentally retarded or adult subjects. According to rigidity theory, younger children would be expected to display more behavioral rigidity than adults. However, studies conducted by Esbenshade (1960) and Zborower (1968) failed to confirm any significant relationship between age and rigidity. Three tests used to measure rigidity were the Wechsler Adult Intelligence Scale, Schaie's Test of Behavioral Rigidity, and Raven's Progressive Matrices.

Assumption Underlying the Hypotheses

From the beginning of research investigating the phenomena, rigidity, there was a search for a neurophysiological cause of rigid behavior. Because mentally deficient and brain-injured persons were observed to manifest more rigid behavior they became the subjects of much study in the field of rigidity. Today, another group of persons observed to exhibit rigid behavior were children with learning disabilities. By definition, children diagnosed as learning disabled have some type of minimal brain dysfunction. After reviewing the historical background, theoretical rationale, and research which linked behavioral rigidity with neurophysiological factors, certain hypotheses were made about the expected results of the present study. The assumption underlying these hypotheses was that children diagnosed as having learning disabilities exhibit a greater amount of behavioral rigidity than children who were considered normal.

Statement of Hypotheses

The following hypotheses were tested at the .05 level of significance:

Hypothesis 1: There will be statistically significant correlations among raw scores on the modified version of the Wechsler Intelligence Scale for Children-Revised, Coding B subtest and Raven's Standard Progressive Matrices.

Hypothesis 2: Students diagnosed as having learning disabilities will yield statistically significant lower mean raw scores than normal students on Raven's Standard Progressive Matrices.

Hypothesis 3: Students diagnosed as having learning disabilities will yield statistically significant lower mean raw scores than normal students on the summed raw scores of Parts 3 and 4 of the modified version of the Wechsler Intelligence Scale for Children-Revised, Coding B subtest.

Limitations

The limitations of the study included a dependence upon 30 pairs of learning disabled and normal students being matched on three variables: sex, age, and intelligence. All the students in two middle schools who had been diagnosed as having learning disabilities, both those who had been placed in a special program for the learning disabled and those who had been recommended for placement were included in the study. This study excluded those children who exhibited learning disorders secondary to other problems, such as mental retardation, educational or cultural deprivation, severe emotional disturbance and sensory handicaps, i.e., the blind, partially sighted, deaf and hard-of-hearing. The subjects were limited to sixth-, seventh-, and eighth-grade students from Jefferson Middle School and Roosevelt Middle School in Oklahoma City, Oklahoma. In addition, this research was limited to the investigation of behavioral rigidity as measured by Raven's Standard Progressive Matrices, and by a modified version of the Wechsler Intelligence Scale for Children-Revised, Coding B subtest.

Definition of Terms

Behavioral Rigidity

The term "rigidity" grew out of related topics, such as perseveration and the analysis of personality traits. It described "behaviors characterized by the inability to change habits, sets, attitudes, and discriminations" (Chown, 1959, p. 195). Goldstein (1943) stated that rigidity "consists of adherence to a present performance in an inadequate way, that is, in a way which does not correspond to the situation" (p. 209). Werner (1946b) defined rigidity in terms of lack of variability of response. "Rigidity, taken in its functional sense, refers to sluggishness in the variation of a response" (p. 43). Lewin (1935, 1936) employed several synonymous terms for the descriptive, phenotypical concept, "rigidity." He used the phrases "behavioral rigidity," "phenomenological rigidity," "external rigidity," "external immobility," and "secondary immobility." The expression was connoted in the varied senses of stereotypy, perseveration, fixity, lack of variability, pedantry, and inflexibility (Kounin, 1948). Although Lewin did not precisely define the term, Luchins (1959) noted that:

> He [Lewin] refers to an increase in external mobility as corresponding to an increase in the wealth of possible varieties of behavior, thus apparently interpreting variability of behavior as an index of behavioral rigidity. (p. 44)

So, Lewin and Goldstein and Werner seemed to agree that the observable fact in behavioral rigidity was the lack of change in behavior, i.e., resistance to undertaking a new kind of response.

For the purposes of this study, the definition of behavioral rigidity was the one employed by Schaie (1955). He constructed a Test of Behavioral Rigidity, to be used with adults, and offered the following definition of behavioral rigidity:

> a tendency to perseverate and resist conceptual change, to resist the acquisition of new patterns of behavior, and to refuse to relinquish old and established patterns. (p. 608)

In this study, behavioral rigidity was measured by a modified version of the Wechsler Intelligence Scale for Children-Revised, Coding B subtest and by Raven's Standard Progressive Matrices.

Perseveration

Neisser coined the term "perseveration" in 1894 to indicate the persistent repetition or continuance of an activity once begun (Levine, 1955, p. 107). Spearman (1932) defined perseveration in terms of mental inertia. According to Spearman's general mental law of inertia "with some persons there is a tendency for mental processes to persist in activity long after the cessation of the conditions to which they were originally due" (p. 52).

Goldstein (1943) viewed perseveration as a special expression of rigidity. H. B. English and A. C. English (1958) noted that perseveration and rigidity could be distinguished: perseveration was the continuation of a response actually going on, manifested as difficulty in shifting from one task to another or as trouble adjusting one's methods to suit a change in conditions, whereas rigidity was resistance to undertaking a new kind of response. Degree of perseveration experienced by subjects in this study was reflected in the scores they obtained on the two measures of behavioral rigidity.

Learning Disabilities

P. I. Myers & Hammill (1969) maintained that the primary considerations involved in a definition of children with learning disabilities were: (a) it must incorporate the spectrum of educational problems evidenced by these children, and (b) it must be precise enough to differentiate such children from others classified as exceptional. They suggested that the major definitions of learning disabilities were in basic agreement on such fundamental points as:

> 1. The principle of disparity.
> 2. The role of demonstrable central nervous system dysfunction in making educational evaluations.
> 3. The emphasis upon basic disorder of the learning process.
> 4. The children excluded by the definition.
>
> (Myers, P. I., & Hammill, 1969, p. 3)

The principle of disparity. Most definitions of learning disabilities have acknowledged that one of the primary indications of learning disabilities was a discrepancy between the child's intellectual potential as estimated by some instrument, such as the Wechsler Intelligence Scale for Children or the Stanford-Binet Intelligence Scale, and the child's academic performance. It has been observed in children with learning disabilities that there was likely to be a gap between the child's mental ability and his actual achievement level. These children have been noted for their under-achievement in academic tasks.

The role of demonstrable central nervous system dysfunction in making educational evaluations. The concept of learning disabilities was based on research done with brain-injured individuals. Clements (1966) hypothesized that learning disabilities were overt symptoms of underlying neurologic disturbance. One of the controversies pervading the field of learning disabilities, in the past, has been the degree to which these signs were causative of, or merely associated with learning disabilities. It was found that children who manifested learning disorders in their behavior did not necessarily demonstrate central nervous system impairment in neurological evaluations. Educationally, the teacher's concern was the child's behavior, i.e., the symptoms manifested by the child. Educational procedures for children with learning disabilities were based on overt behavior. Causality was irrelevant. Consequently, most definitions of children with specific learning disabilities have not included demonstrable central nervous system dysfunction as necessary in classifying a child as being learning disabled.

The emphasis upon basic disorders of the learning processes. Definitions of learning disabilities have emphasized the disruption in the learning processes of these children. The basic learning processes were considered to consist of the receptive and expressive operations employed in perception and response formation, which included the connecting network of pathways or associations between the two systems. Most definitions of learning disabilities have related the cause of the disorder to the inadequate functioning of one of these brain processes. Various definitions have pointed out the detrimental effects of the learning disorder on perceptual, language or motor performance.

Children excluded by the definition. A number of definitions of learning disabilities have excluded a number of children who exhibit learning disorders secondary to other problems. Children with learning disabilities do not primarily fit into any other area of exceptionality. On this basis, many definitions of learning disabilities have eliminated the mentally subnormal, educationally or culturally deprived, severely emotionally disturbed, and children with a sensory deficit such as the blind, partially sighted, deaf, or hard-of-hearing.

Numerous definitions of children with specific learning disabilities have appeared in the literature since the 1950's. Examples of the most commonly accepted definitions are presented below.

Barbara Bateman (1965) defined children with specific learning disabilities as those who

> manifest an educationally significant discrepancy between their estimated potential and actual level of performance related to basic disorders in the learning processes, which may or may not be accompanied by demonstrable central nervous system dysfunction, and which are not secondary to generalized mental retardation, educational or cultural deprivation, severe emotional disturbance, or sensory loss. (p. 220)

The diversity of the professions interested in learning disabilities created confusion in terminology and identification of children with learning disorders. Consequently, a multidisciplinary approach to the problem evolved. One attempt to channel these various viewpoints was an interdisciplinary committee created by the U. S. Office of Education. The following definition was a result of their work.

> Learning disability refers to one or more significant deficits in essential learning processes requiring special educational techniques for remediation.

> Children with learning disability generally demonstrate a discrepancy between expected and actual achievement in one or more areas, such as spoken, read, or written language, mathematics, and spatial orientation.
>
> The learning disability is not primarily the lack of opportunity to learn.
>
> Significant deficits are defined in terms of accepted diagnostic procedures in education and psychology.
>
> Essential learning processes are those currently referred to in behavioral science as involving perception, integration and expression either verbal or nonverbal.
>
> Special-education techniques for remediation refer to educational planning based on the diagnostic procedures and results. (Kass & Myklebust, 1969, p. 399)

In their annual report to the United States Congress in 1968, the National Advisory Committee on Handicapped Children submitted a definition which was incorporated into the Children with Specific Learning Disabilities Act of 1969, PL 91-230, The Elementary and Secondary Amendments of 1969. It stated that:

> children with special learning disabilities exhibit a disorder in one or more of the psychological processes involved in understanding or using spoken or written language. These may be manifested in disorders of listening, thinking, talking, reading, writing, spelling or arithmetic. They include conditions which have been referred to as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia etc. They do not include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance, or to environmental disadvantage. (Lerner, 1971, p. 9)

In February, 1972, at the National Conference of the Association for Children with Learning Disabilities, the following definition was adopted:

> The term "children with specific learning disabilities" means those children who have a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which disorder may manifest itself in imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations. Such disorders include such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. Such term does not include children who have learning problems which are primarily the result of visual, hearing, or motor handicaps, or mental retardation, or emotional disturbance, or environmental disadvantage. Children with specific learning disabilities who also have sensory, motor, intellectual or emotional problems, or are environmentally disadvantaged, should be included in this definition, and may require multiple services. (Kirk, Note 1)

For the purpose of this study, the criteria for students with learning disabilities were: (a) diagnosis and recommendation for placement in a school program for children with learning disabilities, by a certified psychometrist employed by the Oklahoma City public schools, or a licensed psychologist from a private agency, (b) approval of the recommendation for placement by the Director of Placement and Testing for the Oklahoma City public schools, and (c) demonstration of average intelligence, as evidenced by a composite score located between the 25th and 75th percentiles on Raven's *Standard Progressive Matrices*.

Normality

Normal students were those pupils who (a) attended regular classes on a full-time basis, (b) had not been recommended for placement in any type of special education program, and (c) demonstrated average intelligence, as evidenced by a composite score located between the 25th and 75th percentiles on Raven's *Standard Progressive Matrices*.

CHAPTER II

METHOD AND DESIGN

Procedure

Each subject was administered two measures of rigidity. The instruments were administered by a qualified psychometrist and an assistant who had been trained for the task. The assistant was a graduate student with a bachelor of arts degree in psychology and graduate hours in educational psychology. Training of the assistant included the practice of administering the two instruments under supervision. Standardized instructions and testing procedures were used. Both examiners were females. The physical conditions for the testing included empty classrooms which allowed for a minimal amount of noise and disturbance from other classes.

All subjects were individually administered the modified version of the *Wechsler Intelligence Scale for Children-Revised*, Coding B subtest, and Raven's *Standard Progressive Matrices*. The subjects were retested on both measures, five to seven weeks later, to estimate reliability of the instruments.

Population and Sample

The subjects for the study were sixth-, seventh-, and eighth-grade students from Jefferson Middle School and Roosevelt Middle School in Oklahoma City, Oklahoma. The two schools were selected by the Research Coordinator from the Department of Research and Statistics for Oklahoma City public schools and assigned to the present investigator for participation in this study. They were assumed to be representative of the 11 middle schools in the Oklahoma City public school system, since children were transported to the schools from different sections of Oklahoma City to achieve integration. The total population of students with learning disabilities (LD) in the two schools were included in the sampling process. Letters (see Appendix A) were sent to each child's parents requesting permission for the child to participate in the study. One hundred and twenty-three letters were sent. Sixty-five LD students returned the letters with permission from their parents to be tested. Out of the 65, 35 LD students fell within the average range of intelligence according to Raven's Standard Progressive Matrices. These 35 children were isolated as the LD sample. This number declined to 30 because of subject mortality between the first test session and the retest. Each LD student was matched with a student defined as normal according to the specified criteria. The final sample consisted of 30 pairs matched according to age, within 7 months of each other; sex, where there were 27 pairs of males and 3 pairs of females; and average intelligence, as determined by the composite score on Raven's Standard Progressive Matrices falling between the 25th and 75th percentile. Socioeconomic status was assumed homogeneous because of the transportation of students from various locales throughout the city. The ratio of male to female subjects found in each school was reflected in the sample of normal subjects due to the matching procedures. LD students were paired with normal students from the same school, so the number of normal subjects equaled the number of LD students within each school.

Data-Gathering Instruments

Raven's Standard Progressive Matrices

The instruments used to measure behavioral rigidity in this study were Raven's *Standard Progressive Matrices* (PM) and a modified version of the *Wechsler Intelligence Scale for Children-Revised* (WISC-R), Coding B subtest. The PM was comprised of 60 problems where each problem was a matrix design from which a part had been removed. The subject indicated which of the pieces given below was the right one to complete the matrix. Twelve problems formed a set. The first problem was intended to be self-evident. The problems became increasingly more difficult throughout each set. There were five Sets, lettered A to E. According to Raven (1940) in a publication not available to this author, but quoted by others (Bortner, 1965, p. 491; Burke, 1958, p. 199; Wechsler, 1949, p. 257), each set represented a different conceptual theme. The themes of the successive sets were: (a) continuous patterns, (b) figure analogies, (c) progressive alteration of patterns; (d) permutations of figures, and (e) resolution of figures into constituent parts. Raven (1960) considered the test appropriate for subjects who ranged in age from 8 to 65 years.

Content validity. Validity coefficients reported for the PM ranged from .23 to .86 (Burke, 1958, pp. 202-207). The highest correlation was found by Raven (1948) when he obtained a correlation of .86 between the PM scores and Terman mental ages on a sample of 150 normal school children between the ages of 6 and 13.

Concurrent and predictive validity. Studies were conducted to determine the capacity of the PM to differentiate among different groups. From his standardization data on Colchester and Ipswich children, ages 13 to 14, Raven (1939, 1941) presented evidence that the PM was able to differentiate among groups below age 15. Raven (1939) also showed that the PM discriminated between mean scores of five school groups which differed according to experienced teachers' estimates of ability. From the PM scores of 1,407 children and 3,665 adults, Raven (1941) gave evidence that PM discriminated among the mean scores of children at different educational levels, and of children of parents in different occupational groups.

Reliability. A number of studies investigated the reliability of PM. Reliability coefficients reported for PM ranged from .64 to .93 (Burke, 1958, pp. 214-217). Using Sets A and B in Board Form, Raven (1939) found the test-retest reliability coefficient for a group of 56 normal children, 5 to 9 years old, was .86; using Sets A to E, the correlation for 120 normal children, with a mean age of 13.5, was .88. Additional test-retest coefficients reported by Raven (1948) ranged from .88 for a group of 41 children age 13 (plus or minus 1 year) to .83 for 77 adults, age 50 or above. Foulds and Raven (1948b) found coefficients of reliability for volunteer employees which ranged from .83 for a group of 77 workers, age 50 and above, to .93 for 44 workers, under age 30.

The available data on validity and reliability indicated a need for improving the validity and reliability of the PM. The evidence showed relatively good, but not superior validity and reliability for the PM as a measure of intelligence. On the basis of this evidence, the instrument was judged an adequate measure of intelligence for the purposes of the present study.

PM was not only considered a measure of intelligence in this study, but it was also regarded as a measure of rigidity. The thought that PM was a measure of rigidity was based on several sources of information. In the tester's guide for administering PM, Raven (1960) said that PM has been found to have a *g* saturation of .82 (p. 2). Spearman (1932) identified perseveration as a general factor which represented the amount of mental inertia encountered by *g* or the Mental Energy factor. Perseveration is one aspect of behavioral rigidity. This author thought there was a relationship between PM which was reported to contain a heavy loading of *g*, and perseveration, as it represented the amount of mental inertia encountered by *g* as a Mental Energy factor. Also, Raven (1940) found that each set of problems in PM assessed a different conceptual theme of intelligence. Therefore, it was assumed that each set required a different mental attitude or different mental set. One characteristic of rigidity is the inability to change one's attitude when the objective conditions demand it. It was expected that differences in rigidity would be revealed in the performance of the subjects on the five different sets of problems. Another piece of evidence that led this author to use PM as a measure of rigidity, was a study of Storck et al. (1972). They found PM was positively related to the Motor-Cognitive (.49), Psycho-Motor Speed (.52), and Composite Scores (.59) of Schaie's Test of Behavioral Rigidity.

The Modified Version of the WISC-R, Coding B Subtest

The second measure of behavioral rigidity was a modified version of the Wechsler Intelligence Scale for Children-Revised (WISC-R), Coding B subtest. Klatskin et al. (1972) found that subjects identified as minimally brain damaged did less well on the WISC Coding subtest than other subjects. Because children with learning disabilities were suspected of having some kind of minimal brain damage or minimal brain dysfunction, this author decided to modify the Coding B subtest of the WISC-R in an effort to create environmental change in the situation. The modified coding test was constructed on the order of some other tests which had previously been used to test for rigidity, such as the IT test, triangles test, and capitals test used by Bernstein (1924); Lankes' (1915) alphabet test; and Schaie's (1960) opposites test. In these tasks, the subject acquired one response, and was forced to switch from that response to a new response involving identical, or highly similar, stimuli. Each of these tests were designed to measure the ability of the subject to adjust to the stress imposed upon him by constant environmental change, i.e., behavioral rigidity. The modified coding test was constructed in a manner that forced the subject to switch responses to identical stimuli. Furthermore, it was designed with the intent of creating constant environmental change.

A copy of the modified coding test and instructions for administering and scoring it was included in the Appendix B. Parts 1 and 2 were considered practice series. The sum of correct answers on both sections produced a nonrigidity score. In constructing the TBR, Schaie (1955) felt the "practice series" yielded a "nonrigidity" score, which he believed served as an indicator of the individual's performance on the function measured, without the interference due to rigidity (p. 605). The sum of correct answers on Parts 3 and 4 was regarded as a measure of rigidity, on the order of the "rigidity" score obtained by Schaie (1955) i.e., the score indicating the amount of interference resulting when rigid behavior inhibits adjustment to the altered condition" (p. 605).

This chapter discussed the procedure used in obtaining the data, the population and sample utilized in the study, and the instruments employed to measure rigid behavior. The data were gathered by individually administering the two instruments to each subject. Test-retest reliability coefficients were computed to estimate the reliability of the instruments. The subjects were 30 matched pairs of LD and normal students attending one of two middle schools in Oklahoma City, Oklahoma. Two instruments were used to measure rigid behavior: the PM and a modified version of the WISC-R, Coding B subtest. Chapter III presents, analyzes, and interprets the data collected.

CHAPTER III

PRESENTATION, ANALYSIS, AND INTERPRETATION OF THE DATA

The Pearson Product-Moment Correlation Coefficient (r) was used to measure the relationship between the PM and the modified coding test, and the relationship within the subtests of the two instruments. Computations were made to test the difference between means for correlated and independent data. Because the sample size was small, Student's _t_ was employed to analyze the data.

Raw scores obtained on the test and retest of the modified coding test are presented in Tables A and B (Appendix A). Tables C and D show the raw scores of students on the PM (Appendix A).

Test-retest reliability coefficients of correlation for normal students on the PM are presented in Table 1. They ranged from $r = -.06$, $p > .05$ to $r = .64$, $p < .05$. The reliability coefficient for the Composite Score (PM) was $r = .62$, $p > .05$. The correlations for the LD students on the PM (Table 2) ranged from $r = -.20$, $p > .05$ to $r = .62$, $p < .05$. The reliability coefficient for the Composite Score (PM) was $r = .63$, $p < .05$.

Table 1

Correlation Coefficients of Test-Retest Reliability for Normal Students on Sets A-E and Composite Score (PM) of Raven's Standard Progressive Matrices

	SETS A	B	C	D	E	Composite Score (PM)
A	0.50*	0.09	0.26	0.23	0.42*	0.51*
B	0.02	-0.06	0.26	0.20	0.25	0.26
C	0.28	-0.06	0.48*	0.19	0.30	0.40*
D	0.27	0.09	0.42*	0.43*	0.29	0.53*
E	0.22	0.13	0.19	-0.02	0.64*	0.47*
Composite Score (PM)	0.34	0.05	0.47*	0.31	0.52*	0.62*

*p <.05

Table 2

Correlation Coefficients of Test-Retest Reliability for Students with Learning Disabilities on Sets A-E and Composite Score (PM) of Raven's Standard Progressive Matrices

	SETS A	B	C	D	E	Composite Score (PM)
A	0.25	0.31	-0.20	0.34	-0.03	0.35
B	0.26	0.29	0.02	0.26	-0.06	0.35
C	0.01	0.05	0.35	0.35	0.24	0.50*
D	0.44*	0.12	0.03	0.49*	0.06	0.53*
E	0.25	0.10	0.20	0.15	0.30	0.41*
Composite Score (PM)	0.34	0.23	0.17	0.44*	0.19	0.63*

*p <.05

Table 3

Correlation Coefficients of Test-Retest Reliability for Normal Students on the Modified Version of the Wechsler Intelligence Scale for Children, Coding B Subtest

	I	II	III	IV	Composite (Coding)
I	0.87*	0.65*	0.73*	0.78*	0.84*
II	0.72*	0.65*	0.84*	0.82*	0.83*
III	0.66*	0.71*	0.83*	0.72*	0.80*
IV	0.72*	0.67*	0.86*	0.88*	0.86*
Composite (Coding)	0.83*	0.75*	0.91*	0.89*	0.93*

*p < .05

Table 4

Correlation Coefficients of Test-Retest Reliability for Students with Learning Disabilities on the Modified Version of the Wechsler Intelligence Scale for Children, Coding B Subtest

	I	II	III	IV	Composite (Coding)
I	0.85*	0.62*	0.68*	0.75*	0.74*
II	0.67*	0.80*	0.70*	0.76*	0.73*
III	0.79*	0.83*	0.71*	0.77*	0.78*
IV	0.88*	0.78*	0.75*	0.82*	0.85*
Composite (Coding)	0.87*	0.83*	0.78*	0.85*	0.83*

*p < .05

The test-retest reliability correlation coefficients for the modified coding test are presented in Tables 3 and 4. The correlations for the normal group (Table 3) ranged from $r = .65$, $p < .05$ to $r = .93$, $p < .05$. The reliability coefficient for the Composite Score (Coding) was $r = .93$, $p < .05$. Correlations for the LD group (Table 4) ranged from $r = .62$, $p < .05$ to $r = .88$, $p < .05$. The reliability coefficient for the Composite Score (Coding) was $r = .83$, $p < .05$.

Table 5

Within-Test Correlation Coefficients for Normal Students on Sets A-E of Raven's Standard Progressive Matrices

	A	B	C	D	E
A	1.00	0.01	0.12	0.34	0.40*
B		1.00	-0.11	-0.04	0.04
C			1.00	0.32	0.13
D				1.00	0.16
E					1.00

*p<.05

Table 6

Within-Test Correlation Coefficients for Students with Learning Disabilities on Sets A-E of Raven's *Standard Progressive Matrices*

	A	B	C	D	E
A	1.00	-0.02	0.09	0.13	-0.12
B		1.00	-0.24	0.30	-0.14
C			1.00	-0.08	0.05
D				1.00	-0.19
E					1.00

The within-test correlations for the PM are presented in Tables 5 and 6. Table 5 showed one significant correlation ($r = .40$, $p < .05$) between A and E. There are no significant correlations in Table 6.

Table 7

Within-Test Correlation Coefficients for Normal Students on the Modified Version of the *Wechsler Intelligence Scale for Children*, Coding B Subtest

	I	II	III	IV
I	1.00	0.73*	0.77*	0.80*
II		1.00	0.74*	0.71*
III			1.00	0.88*
IV				1.00

*$p < .05$

Table 8

Within-Test Correlation Coefficients for Students with Learning Disabilities on the Modified Version of the Wechsler Intelligence Scale for Children, Coding B Subtest

	I	II	III	IV
I	1.00	0.74*	0.76*	0.83*
II		1.00	0.78*	0.73*
III			1.00	0.81*
IV				1.00

*$p < .05$

The within-test correlations for the modified coding test are shown in Tables 7 and 8. Coefficients for the normal students (Table 7) ranged from $r = .71$, $p < .05$ to $r = .88$, $p < .05$. Results for the LD students ranged from $r = .73$, $p < .05$ to $r = .83$, $p < .05$ (Table 8).

Between-test correlation coefficients for the PM and the modified coding test are presented in Tables 9 and 10. Table 9 showed no significant correlations between the instruments for normal students. Two significant correlations are presented in Table 10. A coefficient of $r = .46$, $p < .05$ between Set A of PM and Part 1 of the modified coding task, and a coefficient of $r = .40$, $p < .05$ between Set A of PM and Part 4 of the modified coding test was obtained for the LD sample.

Table 9

Between-Test Correlation Coefficients for Normal Students on the Modified Version of the Wechsler Intelligence Scale for Children, Coding B Subtest and on Sets A-E of Raven's Standard Progressive Matrices

	I	II	III	IV
A	0.16	0.08	0.33	0.23
B	0.21	0.29	0.10	0.17
C	-0.13	-0.39	-0.08	-0.03
D	-0.19	-0.03	-0.04	0.11
E	0.33	0.09	0.16	0.23

Table 10

Between-Test Correlation Coefficients for Students with Learning Disabilities on the Modified Version of the Wechsler Intelligence Scale for Children, Coding B Subtest and on Sets A-E of Raven's Standard Progressive Matrices

	I	II	III	IV
A	0.46*	0.34	0.24	0.40*
B	0.06	0.30	0.32	0.22
C	-0.04	-0.17	-0.16	0.04
D	-0.08	0.21	0.14	0.20
E	0.18	0.07	0.14	0.26

*$p < .05$

Table 11

t-Values of Correlated Data for Normal Students[a] on Sets A-E and Composite Score (PM) of Raven's Standard Progressive Matrices

	TEST Mean	TEST Standard Deviation	RETEST Mean	RETEST Standard Deviation	F_{max} Value	Mean Difference	Std. Error of Mean Difference	t Value
A	10.93	0.78	11.03	0.96	1.51	0.10	0.16	0.62
B	8.70	1.80	9.93	1.53	1.39	1.23	0.44	2.78*
C	6.90	1.37	7.43	1.57	1.30	0.53	0.27	1.94*
D	6.90	1.54	7.67	1.97	1.64	0.77	0.35	2.20*
E	2.50	2.08	2.90	1.54	1.83	0.40	0.29	1.36
Composite Score (PM)	35.93	4.18	38.97	5.35	1.64	3.03	0.79	3.86*

[a]$n=30$
*$p < .05$

Table 12

t-Values of Correlated Data for Normal Students[a] on Parts 1-4 of the Modified Version of the Wechsler Intelligence Scale for Children, Coding B Subtest

	TEST Mean	TEST Standard Deviation	RETEST Mean	RETEST Standard Deviation	F_{max} Value	Mean Difference	Std. Error of Mean Difference	t Value
I	45.50	10.54	55.60	12.54	1.41	10.10	1.14	8.84*
II	49.77	9.21	60.53	11.98	1.69	10.77	1.68	6.40*
III	47.67	9.52	55.37	13.75	2.09	7.70	1.45	5.29*
IV	46.40	9.81	54.13	11.80	1.45	7.73	1.03	7.54*

[a]$n=30$
*$p < .05$

The results of tests for differences between means on correlated data from normal students were presented in Tables 11 and 12. The test for a difference between the mean raw score on the first testing and the retest on the PM (Table 11) for Set B yielded a t value of t (29) = 2.78, $p < .05$; Set D, t (29) = 2.20, $p < .05$; Composite Score (PM), t (29) = 3.86, $p < .05$. Table 12 showed significant t values for all parts of the modified coding test.

Table 13

t-Values of Correlated Data for Students[a] with Learning Disabilities on Sets A-E and Composite Score (PM) of Raven's Standard Progressive Matrices

	TEST Mean	TEST Standard Deviation	RETEST Mean	RETEST Standard Deviation	F_{max} Value	Mean Difference	Std. Error of Mean Difference	t Value
A	10.97	0.85	11.20	0.85	1.01	0.23	0.19	1.23
B	9.40	1.50	10.30	1.47	1.05	0.90	0.32	2.79*
C	6.90	1.32	7.27	1.62	1.50	0.37	0.31	1.19
D	7.27	1.95	8.53	1.43	1.85	1.27	0.32	3.94*
E	2.17	1.32	2.93	1.96	2.23	0.77	0.37	2.09*
Composite Score (PM)	36.73	3.10	40.23	5.04	2.65	3.50	0.71	4.91*

[a] n=30
*$p < .05$

Table 14

t-Values of Correlated Data for Students[a] with Learning Disabilities on Parts 1-4 of the Modified Version of the Wechsler Intelligence Scale for Children, Coding B Subtest

	TEST Mean	TEST Standard Deviation	RETEST Mean	RETEST Standard Deviation	F_{max} Value	Difference	Std. Error of Mean Difference	t Value
I	40.27	9.77	46.50	12.20	1.56	6.23	1.19	5.24*
II	48.30	11.17	54.27	11.41	1.04	5.97	1.29	4.62*
III	41.60	10.88	47.13	11.05	1.03	5.53	1.52	3.63*
IV	41.50	9.38	47.97	11.98	1.63	6.47	1.24	5.21*

[a]n=30
*p<.05

The results of tests for differences between the means on correlated data from LD students are presented on Tables 13 and 14. A significant difference between the mean of the first testing and the retest on the PM (Table 13) was obtained for Set B, t (29) = 2.79, $p < .05$; Set D, t (29) = 3.94, $p < .05$; Set E, t (29) = 2.09, $p < .05$; Composite Score (PM), t (29) = 4.91, $p < .05$. Table 14 showed a significant difference between the mean raw scores of LD students on the first testing and retest for all parts of the modified coding test.

Table 15 showed the results of tests for differences between means on independent data. The F_{max} statistic

Table 15

t-Values of Independent Data for Normal and Learning Disabled Students[a] on Sets A-E and Composite Score (PM) of Raven's Standard Progressive Matrices, and the Summed Means of Parts 3 and 4 of the Modified Version of the Wechsler Intelligence Scale for Children, Coding B Subtest

			Mean	Standard Deviation	Std. Error of the Mean	F_{max} Value	P Value	t Value
Raven's Standard Progressive Matrices	A	N.	10.93	0.79	0.14	1.17	0.88	-0.16
		L.D.	10.97	0.85	0.15			
	B	N.	8.70	1.80	0.33	1.45	0.11	-1.63
		L.D.	9.40	1.50	0.27			
	C	N.	6.90	1.37	0.25	1.08	1.00	0.0
		L.D.	6.90	1.32	0.24			
	D	N.	6.90	1.54	0.28	1.60	0.42	-0.81
		L.D.	7.27	1.95	0.35			
	E	N.	2.50	2.08	0.38	2.50	0.46	0.74[b]
		L.D.	2.17	1.31	0.24			
Composite Score (PM)		N.	35.93	4.19	0.76	1.83	0.40	-0.84
		L.D.	36.73	3.09	0.57			
Summed Means Parts 3 & 4		N.	94.07	18.73	3.42	1.06	0.03	2.24*
		L.D.	83.10	19.26	3.52			

[a] n=30 pairs

[b] the t-Value of the Separate Variance Estimate was substituted for the t-Value of the Pooled Variance Estimate

*p<.05

was computed to test for homogeneity of variance. In one case, on Set E, the value of F_{max} exceeded the critical value, 2.09. Therefore, the t value associated with the separate variance estimate was used rather than the t value associated with the pooled variance estimate. Table 15 showed that none of the t values for PM were significant.

Parts 3 and 4 of the modified coding test were summed as a measure of rigidity. The normal group yielded a mean raw score of $\bar{X} = 94.1$ and the LD group yielded a mean of $\bar{X} = 83.1$ (Table 15). A test for difference between means yielded a significant t value of $t\ (58) = 2.24$, $p < .05$.

A test for significance between means for both groups on Part 1 of the modified coding test was computed. The normal group yielded a mean raw score of $\bar{X} = 45.5$ on Part 1 and the LD group yielded a mean of $\bar{X} = 40.3$. The test for a difference between means yielded a significant t value of $t\ (58) = 1.99$, $p < .05$.

An inspection of the means on Tables A-D revealed that the LD group consistently scored lower than the normal group on all parts of the modified coding test. Also, the mean performance of the LD students on Parts 3 and 4 ($\bar{X} = 83.1$) was lower than their mean performance on Parts 1 and 2 ($\bar{X} = 88.6$). The normal students obtained a mean of $\bar{X} = 94.1$ for Parts 3 and 4, and a mean of $\bar{X} = 95.3$ on Parts 1 and 2.

Interpretation of the Data

Analysis of the data for this sample showed that the PM produced consistent results from test to retest when taken as a composite score. This was shown by a reliability coefficient of $\underline{r} = .62$, $\underline{p} < .05$ for the normal students and $\underline{r} = .63$, $\underline{p} < .05$ for the LD students. The individual sets, A-E, showed less consistent results from test to retest. The correlations of test to retest within the sets were not uniformly significant, as shown by the coefficients in Tables 1 and 2.

The test-retest reliability coefficients for the modified coding test found in Tables 3 and 4 were high for both groups. The significant correlations indicated that all parts of the instrument produced consistent results from test to retest. Results suggested that the modified coding test was a reliable measure of rigidity. The relatively lower correlations of the LD sample suggested the test was less reliable for this group than for the normal students.

The within-test correlations for PM shown in Tables 5 and 6, with one exception, were not significant. The only significant correlation occurred between Sets A and E ($\underline{r} = .40$, $\underline{p} < .05$) for the normal students, and this was at the lower limit of the critical value. There was little relationship between the students' performance on one set of problems and their performance on any of the other sets.

The significant within-test correlations between Parts 1-4 of the modified coding test, which appeared in Tables 7 and 8, demonstrated good consistency from one coding task to another. Table 15 also showed a larger discrepancy that occurred between the mean scores on the practice series of the LD students (Parts 1 and 2, $\bar{X}$ = 88.6) and the measure of rigidity (Parts 3 and 4, $\bar{X}$ = 83.1) than occurred between the mean scores for the normal group (Part 1 and 2, $\bar{X}$ = 95.3; Parts 3 and 4, $\bar{X}$ = 94.1). The LD group obtained a significantly lower mean raw score on Part 1 of the modified coding test than the normal group (t [58] = 1.99, p < .05). The data indicated that the original Coding B subtest of the WISC-R (Part 1) measured rigidity as well as the modified tasks (Parts 2-4).

The general lack of correlation between the two instruments, shown in Tables 9 and 10, demonstrated low consistency from one test to the other. Perhaps Sets A-E of the PM measured five different conceptual themes related to intelligence which were not affected by rigidity, while Parts 1-4 of the modified coding test assessed behavioral rigidity.

The results of tests for differences between means on correlated data shown in Tables 11 through 14 indicated that the sample tested the first time on these particular subtests of the two instruments was different from the population measured on the retest. Upon further inspection of the data, it was observed that the mean scores increased between test and retest in every case. It was thought that the differences found between the means was a result of the influence of practice effect. The influence of practice effect on all parts of the modified coding test was stronger for normal students than LD students. This was shown by an increment of the mean raw scores from test to retest which was larger for the normal group than for the LD group. The difference in performance was also reflected in the higher _t_ values of the normal students for Parts 1-4 of the modified coding test. The observation that LD children appeared not to learn from previous experiences as readily as normal children was substantiated by this finding.

Computations on independent data (Table 15) demonstrated no significant difference between the means of the two groups on Sets A-E of PM or on the Composite Score (PM). Any difference in the performance of the two groups on PM, was assumed to be due to behavioral rigidity rather than a difference in intelligence since the subjects were matched according to intelligence. However, there was no significant difference between the means of the two groups on PM: (a) either there was no significant difference between the two groups in rigid behavior or, (b) PM was not an adequate measure of rigidity. Because LD students were more rigid in their performance on Parts 3 and 4 of the modified coding test, it was thought that PM was not an adequate measure of rigidity.

The two groups of students performed differently on Parts 3 and 4 of the modified coding test, the rigidity measure, as evidenced by a significant difference between the means of the two groups (t [58] = 2.24, $p < .05$). The mean for the normal students ($\bar{X}$ = 94.1) was significantly higher than the mean ($\bar{X}$ = 83.1) for the LD students. The LD students exhibited more rigid behavior on Parts 3 and 4 of the modified coding test than did the normal students.

CHAPTER IV

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This study was an effort to determine whether sixth-, seventh-, and eighth-grade students diagnosed as having learning disabilities differed from normal students in rigidity of behavior. Rigid behavior was measured by a modified version of the WISC-R, Coding B subtest, and by Raven's Standard Progressive Matrices. In addition, the relationship between each of the scores obtained on the two measures of behavioral rigidity was investigated.

All subjects were individually administered the two instruments. The subjects were retested on both measures five to seven weeks later to estimate the reliability of the instruments.

Findings and Conclusions

Three hypotheses were made at the beginning of the study which were tested on the data that have been presented and analyzed. The following results were found regarding the hypotheses.

> Hypothesis 1: There will be statistically significant correlations among raw scores on the modified version of the Wechsler Intelligence Scale for Children-Revised, Coding B subtest, and on Raven's Standard Progressive Matrices.

This hypothesis was partially substantiated. The between-test correlations for the normal group were not significant. There were significant correlations for the LD group between Set A of PM and Part 1 of the modified coding test, and between Set A of PM and Part 4 of the modified coding test. There was low consistency from a subject's performance on one instrument to his performance on the other instrument.

> Hypothesis 2: Students diagnosed as having learning disabilities will yield statistically significant lower mean raw scores than normal students on Raven's Standard Progressive Matrices.

This hypothesis was rejected. There was no statistically significant difference between the performance of the students with learning disabilities and normal students on Sets A-E, and the Composite Score (PM) of Raven's Standard Progressive Matrices. Scores on the matrices test did not reflect rigid behavior in this sample of students. Also, there was no significant difference between the groups with respect to intelligence. Both groups had average intelligence.

> Hypothesis 3: Students diagnosed as having learning disabilities will yield statistically significant lower mean raw scores than normal

> students on the summed raw scores of Part 3 and 4 of the modified version of the <u>Wechsler Intelligence Scale for Children-Revised</u>, Coding B subtest.

This hypothesis was accepted. Students diagnosed as having learning disabilities obtained a mean raw score of $\bar{X} = 83.1$ on the summed raw scores of parts 3 and 4 of the modified coding test; normal students obtained a mean raw score of $\bar{X} = 88.6$. There was a statistically significant difference ($t\,[58] = 2.24$, $p < .05$) between the means of the two groups on this measure of rigidity. Children with learning disabilities were more rigid than normal children in their behavior.

In terms of the rigidity theories discussed earlier, children with learning disabilities tended to exhibit more stereotyped, pedantic, perseverating behavior than normal children. The behavior of LD students was also less differentiated. They had a difficult time adjusting to frequent change in the environment. Stronger <u>Gestalten</u> were formed by the LD group than the normal group which made it difficult for them to restructure the organization of their psychical structure. Consequently, they were not able to benefit from previous experiences as readily as normal students.

From the results of the analysis of the data, several conclusions were reached. (a) Students with learning disabilities exhibited more rigid behavior than normal students. (b) The summed means of the scores on Parts 3 and 4 of the modified coding task was an adequate measure of rigidity. (c) The original WISC-R, Coding B subtest (Part 1) measured rigidity as well as the modified tasks (Parts 2-4). (d) Raven's Standard Progressive Matrices was not an adequate measure of rigidity.

Recommendations for Further Study

Several recommendations for further study evolved from this investigation. Perhaps future studies should not use Raven's Standard Progressive Matrices as a measure of rigidity. It was suggested that additional studies were necessary to investigate the validity of the modified coding test as a measure of rigid behavior. The results of this study indicated that investigators in future studies would probably find it unnecessary to use Parts 2-4 of the modified coding test, since the original WISC-R, Coding B subtest was an effective measure of rigid behavior. It was suggested that further studies employ the WISC-R, Coding B subtest to investigate the qualitative and quantitative differences in rigid behavior of brain-injured mentally retarded children and learning disabled population, i.e., does rigid behavior decrease with an increase in age? Perhaps, the WISC-R, Coding A subtest should be studied as a possible measure of rigid behavior in children below the age of eight years. This study only explored one of the popular stereotypes of learning disabilities which had not received empirical support. Perhpas, further studies should attempt to systematically gather evidence demonstrating other characteristics which have been associated with learning disabilities.

Reference Note

1. Kirk, S. A. Definition prepared by the National Advisory Board to the Association of Children with Learning Disabilities presented for adoption by Samual Kirk at a meeting of the National Board of Directors for the Association of Children with Learning Disabilities, February 1972.

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APPENDIX A

Letters Requesting Parental Permission for Students to Participate in the Study

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Dear Parent or Guardian:

I am conducting educational research in the Oklahoma City public schools which will help us learn more about abilities and learning patterns of children. We hope this information will help teachers do a more effective job of instructing students. We would like your child to participate in this study. In order to do this, we need permission to test your child on an individual basis. The tests will be administered by a qualified examiner. A follow-up testing session will be held later in the semester. Individual test results will remain anonymous and confidential. This testing will not effect your child's placement in the public schools nor will it be entered on his/her permanent records. The completed results of the study will be available upon request. If you have any questions or need further information, please contact Linda Wagner between 9:00 and 10:00 AM on Monday or Wednesday at 325-5016 or Mrs. Creecy at Jefferson Middle School (632-2341) during regular school hours.

Sincerely,

Linda L. Wagner

PARENTAL PERMISSION FOR INDIVIDUAL TESTING

I hereby give permission for my child, ______________________,
to be administered individual tests as part of the educational research being conducted at Jefferson Middle School.

____
Parent/Guardian

Dear Parent or Guardian,

I am conducting educational research in the Oklahoma City Public schools which will help us learn more about abilities and learning patterns of children. We hope this information will help teachers do a more effective job of instructing students. We would like your child to participate in this study. In order to do this, we need permission to test your child on an individual basis. The tests will be administered by a qualified examiner. A follow-up testing session will be held later in this semester. Individual test results will remain anonymous and confidential. This testing will not effect your child's placement in the public schools nor will it be entered in his/her permanent records. The completed results of the study will be available upon request. If you have any questions or need further information, please contact Mrs. Weese at Roosevelt Middle School (685-7795) between 2:45 and 3:30 P.M. Your cooperation in this matter and the prompt return of this form will be greatly appreciated.

Sincerely,

Linda L. Wagner

PARENTAL PERMISSION FOR INDIVIDUAL TESTING

I hereby give permission for my child, ____________________,
to be administered individual tests as part of the educational research being conducted at Roosevelt Middle School.

____
Parent/Guardian

APPENDIX B

The Modified Version of the *Wechsler Intelligence Scale for Children*, Coding B Subtest, Parts 2-4

MODIFIED VERSION OF THE WISC-R, CODING-B SUBTEST

Directions

Part 2:

"Look at these divided boxes or squares (pointing to the key). Notice that each has a mark on the upper part and a number on the lower part. Every mark has a different number. Now look here (pointing to the Sample). These boxes have marks, but the squares beneath have no numbers. I want you to put in each of these squares (pointing to the seven Sample boxes) the numbers that should go there, like this."

Illustrate by pointing to the Key and then to the Sample, saying: "Here is this mark, so you put in a number 2." After marking the first three Sample items, say: "Now you do it." If the Subject does not grasp the task, help him with more items until the seven Sample items have been filled in.

After this demonstration, say: "Now begin here and fill in as many squares as you can without skipping any. Keep working until I tell you to stop. Go ahead." Begin timing. If the Subject starts to omit squares or do only one number, say: "Do them in order."

Timing: 120 seconds

Scoring: 1 point for each square filled correctly. The seven Sample items are not included in the Subject's score. Corrections and erasures are counted incorrect.

Maximum score: 93 points

Part 3:

"Look at these divided boxes or squares (pointing to the Key). Notice that each has a number on the upper part and a mark on the lower part. Every number has a different mark. Now look here (pointing to the Sample). Some of these boxes have numbers and some of the boxes have marks. I want you to put in each of these squares (pointing to the seven Sample boxes) the number or mark that should go there, like this."

Illustrate by pointing to the Key and then to the Sample, saying: "Here is this mark so you put in the number 2. Here is the number 1, so you put in this mark." After marking the first three Sample items, say: "Now you do it." If the Subject does not grasp the task, help him with more items until the seven Sample items have been filled in.

After this demonstration say: "Now begin here and fill in as many squares as you can without skipping any. Keep working until I tell you to stop. Go ahead." Begin timing. If the Subjects starts to omit squares or do only one symbol say: "Do them in order."

Timing: 120 seconds

Scoring: 1 point for each square filled in correctly. The seven Sample items are not included in the Subject's score. Corrections and erasures are counted incorrect.

Maximum score: 93 points

Part 4:

"Look at these divided boxes or squares (pointing to the Key). Notice that each has a number on the upper part and a Mark on the lower part. Every number has a different mark. Now look here (pointing to the Sample). Some of these boxes have numbers on the top and some of the boxes have numbers on the bottom. Some of boxes have marks on the top and some have marks on the bottom. I want you to put in each of these empty squares (pointing to the seven Sample boxes) the number or mark that should go there, like this."

Illustrate by pointing to the Key and then to the Sample, saying: "Here is this mark in the box on top so you put the number 2 in the box on bottom. Here is the number 1 in the bottom box so you put this mark in the box on top." After marking the first three Sample items, say: "Now you do it." If the Subject does not grasp the task, help him with more items until the seven Sample items have been filled in.

After this demonstration say: "Now begin here and fill in as many squares as you can without skipping any. Keep working until I tell you to stop. Go ahead." Begin timing. If the Subject starts to omit squares or do only one symbol, say: "Do them in order."

<u>Timing</u>: 120 seconds

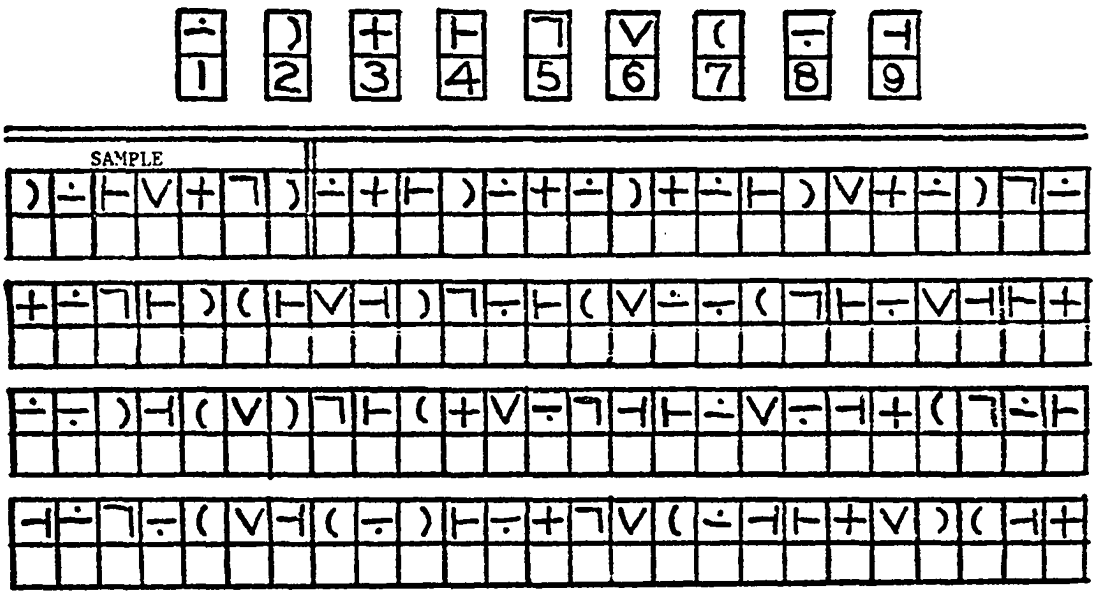
<u>Scoring</u>: 1 point for each square filled in correctly. The seven Sample items are not included in the Subject's score. Corrections and erasures are counted incorrect.

<u>Maximum score</u>: 93 points

NAME________________

MODIFIED VERSION OF THE WISC-R, CODING B SUBTEST

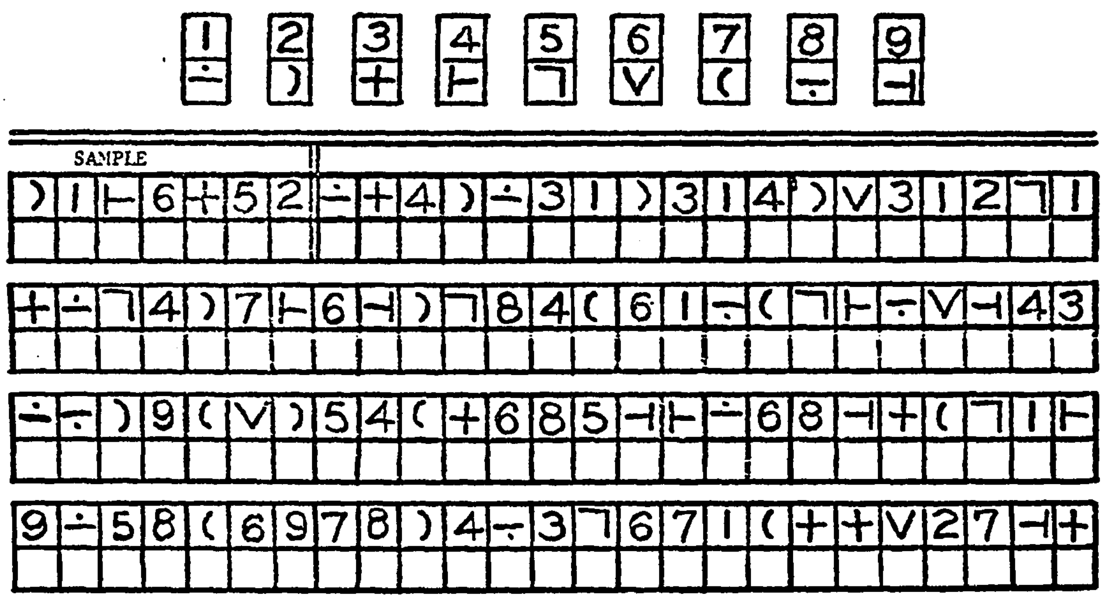
PART 2



TIME (120")______ SCORE (NO. RIGHT)______

NAME_______________________

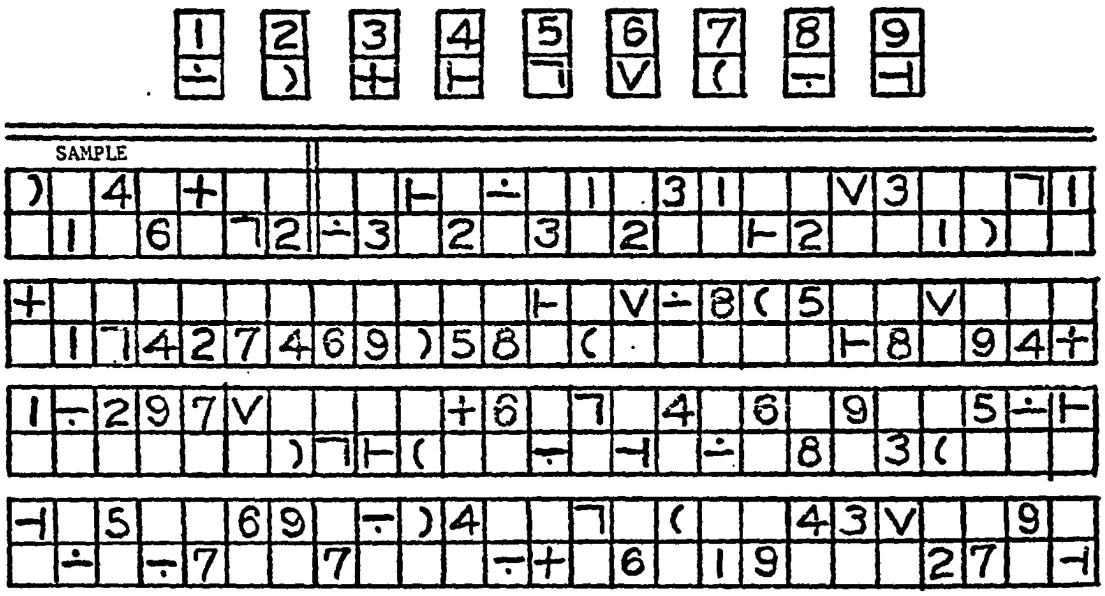
PART 3



TIME (120")______SCORE (NO. RIGHT)______

NAME____________________

PART 4



TIME (120")______SCORE (NO. RIGHT)______

APPENDIX C

Raw Data for Normal and Learning Disabled Students on the Modified Verson of the Wechsler Intelligence Scale for Children, Coding B Subtest, and Raven's Standard Progressive Matrices

Table A

Raw Scores of Students With Learning Disabilities for the Test and Retest on Sets A-E and Composite Score (PM) of Raven's Standard Progressive Matrices

Subject Number	A		B		C		D		E		Composite Score (PM)	
	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
1	11	11	10	12	9	8	7	9	5	7	42	47
2	11	12	11	10	7	7	4	7	2	2	35	38
3	11	12	11	10	5	7	7	9	2	1	37	39
4	12	12	9	10	7	7	8	10	4	6	40	45
5	12	12	9	9	7	7	7	9	1	6	36	43
6	11	12	12	11	7	8	6	9	1	4	37	44
7	12	12	10	11	8	7	6	9	2	2	38	41
8	11	12	8	10	6	9	9	9	3	0	37	40
9	12	12	10	11	6	6	10	10	1	4	39	43
10	10	11	9	11	8	9	10	8	2	3	39	42
11	11	9	6	6	8	4	5	5	1	1	31	25
12	12	10	10	11	7	8	8	9	0	4	37	42
13	12	12	8	12	4	6	7	10	1	3	32	43
14	11	11	10	12	8	10	9	10	2	3	40	46
15	11	11	11	10	6	7	9	7	2	3	39	38
16	10	10	8	11	9	6	6	9	1	1	34	37
17	9	12	9	8	6	9	9	8	3	1	36	38
18	10	10	9	11	5	4	4	6	4	1	32	32
19	10	11	7	8	7	5	4	8	2	2	30	34
20	10	12	9	12	8	10	7	8	2	6	36	48
21	10	11	9	9	6	9	8	10	4	7	37	46
22	11	12	10	12	6	7	7	6	2	2	36	39
23	12	11	6	11	9	9	6	9	2	1	35	41
24	11	10	9	10	6	8	4	9	5	3	35	40
25	10	11	11	11	7	7	8	8	0	1	36	38
26	11	11	10	12	5	6	10	9	1	3	37	41
27	10	10	11	8	7	6	6	6	2	2	36	32
28	12	12	11	11	8	8	11	11	2	3	44	45
29	12	11	8	10	9	9	7	9	4	5	40	44
30	11	11	11	9	6	5	9	10	2	1	39	36
Mean	10.97	11.20	9.40	10.30	6.90	7.27	7.27	8.53	2.17	2.93	36.73	40.23
Standard Deviation	0.85	0.85	1.50	1.47	1.32	1.62	1.95	1.43	1.32	1.97	3.10	5.04

Table B

Raw Scores of Normal Students for the Test and Retest on Sets A-E and Composite Score (PM) of Raven's Standard Progressive Matrices

Subject Number	A		B		C		D		E		Composite Score (PM)	
	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
1	11	12	10	12	5	8	6	7	1	2	33	41
2	10	11	11	7	6	6	7	8	1	3	35	35
3	11	11	9	10	7	6	5	9	3	3	35	39
4	11	11	8	12	8	10	8	10	6	6	41	49
5	10	10	7	9	8	7	6	6	1	1	32	33
6	11	11	10	8	8	10	7	9	3	4	39	42
7	10	12	8	10	8	8	6	6	6	6	38	42
8	12	11	9	8	8	8	5	7	0	3	34	37
9	12	12	10	10	5	9	7	11	8	6	42	48
10	10	11	8	11	8	10	4	10	2	5	32	47
11	12	12	7	9	7	7	8	9	1	2	35	39
12	11	12	8	10	8	8	9	8	1	3	35	41
13	11	12	9	11	8	6	7	8	2	3	37	40
14	12	12	10	11	9	9	7	5	6	2	44	39
15	11	10	3	11	8	9	8	9	3	2	33	41
16	11	10	6	6	5	6	7	3	0	0	29	25
17	10	9	10	9	4	6	5	4	1	3	30	31
18	11	11	12	9	8	6	9	10	3	3	43	39
19	9	9	10	9	7	6	5	6	0	1	31	31
20	12	11	9	8	6	7	9	8	5	3	41	37
21	12	12	8	11	8	8	8	8	5	4	41	43
22	11	12	11	11	7	8	7	8	1	2	37	41
23	11	11	9	9	5	5	4	6	2	2	31	33
24	10	11	9	12	5	5	8	7	2	1	34	36
25	11	11	8	10	6	7	7	7	2	4	34	39
26	12	10	11	11	7	10	8	9	2	4	40	44
27	11	11	8	10	5	5	5	5	4	2	33	33
28	11	12	6	11	7	7	7	9	2	4	33	43
29	10	9	8	11	7	9	8	7	0	1	33	37
30	11	12	9	12	9	7	10	11	2	2	41	44
Mean	10.93	11.03	8.70	9.93	6.90	7.43	6.90	7.67	2.50	2.90	35.93	38.97
Standard Deviation	0.78	0.96	1.80	1.53	1.37	1.57	1.54	1.97	2.08	1.54	4.18	5.35

Table C

Raw Scores of Students With Learning Disabilities for the Test and Retest on Parts 1-4 and Composite Score (Coding) of the Modified Version of the <u>Wechsler Intelligence Scale for Children</u>, Coding B Subtest

Subject Number	I		II		III		IV		Composite (Coding)	
	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
1	45	54	46	55	47	51	54	54	192	316
2	37	49	46	62	39	46	36	49	158	206
3	52	51	59	59	46	55	53	64	210	229
4	51	54	55	65	48	53	53	63	207	235
5	44	52	61	62	51	51	40	54	196	219
6	34	53	50	61	36	55	40	52	160	221
7	38	44	47	77	42	50	43	42	170	213
8	35	51	48	56	33	53	45	50	161	210
9	54	61	58	74	62	55	60	61	224	251
10	24	28	34	39	34	27	32	35	124	129
11	42	45	31	41	21	34	35	40	129	160
12	42	53	35	47	37	35	42	45	156	180
13	42	40	48	46	47	46	35	50	172	182
14	61	65	78	74	65	67	62	68	266	283
15	36	38	56	52	36	38	37	42	165	170
16	31	19	37	43	30	37	36	37	134	136
17	29	41	41	48	38	43	35	36	143	168
18	45	49	51	50	51	40	44	45	191	184
19	42	51	54	58	46	55	43	52	185	216
20	37	44	37	40	34	39	31	35	139	158
21	21	27	31	35	30	34	30	36	112	132
22	31	34	40	54	40	44	37	34	148	166
23	31	41	35	39	20	37	26	30	112	147
24	61	72	56	63	53	70	48	76	218	281
25	40	51	50	53	55	42	40	47	185	193
26	37	34	62	64	34	50	35	49	168	197
27	30	32	38	39	30	36	27	32	125	139
28	46	51	61	61	51	54	52	50	110	226
29	51	70	60	65	52	64	53	70	216	269
30	39	41	44	46	40	44	41	41	164	172
Mean	40.27	46.50	48.30	54.27	41.60	47.13	41.50	47.97	168.00	196.20
Standard Deviation	9.77	12.20	11.17	11.41	10.88	11.05	9.38	11.98	37.90	42.85

Table D

Raw Scores of Normal Students for the Test and Retest on Parts 1-4 and Composite Score (Coding) of the Modified Version of the Wechsler Intelligence Scale for Children, Coding B Subtest

Subject Number	I Test	I Retest	II Test	II Retest	III Test	III Retest	IV Test	IV Retest	Composite (Coding) Test	Composite (Coding) Retest
1	67	70	72	87	70	81	67	78	276	316
2	40	53	56	52	39	42	34	43	169	190
3	43	55	42	40	37	40	36	40	158	175
4	57	68	53	65	51	57	49	49	210	239
5	25	36	37	50	44	49	34	41	140	176
6	47	58	51	64	39	51	44	49	181	222
7	50	51	40	51	40	52	41	51	171	205
8	43	57	39	62	51	50	36	53	169	222
9	67	80	68	78	64	83	64	84	263	325
10	54	54	47	57	48	47	47	52	196	210
11	42	43	47	57	48	58	45	52	182	210
12	50	62	55	72	59	64	62	63	226	261
13	54	77	66	63	61	74	53	64	234	278
14	38	49	45	55	43	52	41	54	167	210
15	34	45	51	56	44	37	45	49	164	187
16	34	47	48	61	39	53	35	50	156	211
17	37	42	46	44	36	41	36	38	155	165
18	55	78	50	69	54	35	59	67	218	249
19	42	51	44	56	41	53	47	57	174	217
20	35	43	41	51	46	52	40	46	162	192
21	58	69	57	89	62	82	62	80	239	320
22	40	49	52	67	56	71	54	67	202	254
23	61	76	67	74	62	77	60	64	250	291
24	37	38	56	41	40	40	42	42	175	161
25	41	39	50	52	40	49	34	47	165	187
26	40	55	43	55	39	46	44	48	166	204
27	46	51	46	63	49	63	46	51	187	228
28	51	65	42	56	46	56	50	50	189	227
29	49	60	52	74	48	63	46	46	195	243
30	28	47	40	55	34	43	39	49	141	194
Mean	45.50	55.60	49.77	60.53	47.67	55.37	46.40	54.13	189.33	225.63
Standard Deviation	10.54	12.54	9.21	11.98	9.53	13.75	9.81	11.80	35.58	44.82