THE RELATIONSHIP BETWEEN INTELLIGENCE STRUCTURE
AND PSYCHOLINGUISTIC ABILITIES IN
LEARNING-DISABLED CHILDREN

DISSERTATION

Presented to the Graduate Council of the
North Texas State University in Partial
Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

By

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Denton, Texas
December, 1973

This study was conducted to investigate the relationship between the subtests of the Wechsler Intelligence Scale for Children (WISC) and the Illinois Test of Psycholinguistic Abilities (ITPA) and to investigate whether High Verbal-Low Performance (HV-LP) scorers on the WISC score significantly higher on certain ITPA subtests than High Performance-Low Verbal (HP-LV) scorers, and whether HP-LV scorers on the WISC score significantly higher on certain other subtests of the ITPA. Two main hypotheses were investigated in an effort to accomplish these purposes.

The subjects used in this study were the 132 children who were referred to the Pupil Appraisal Center, North Texas State University, Denton, Texas, who were administered both the ITPA and the WISC. The children were referred to the center because of lack of school achievement. Test scores were obtained following a careful review of the records of the total population referred to the Pupil Appraisal Center during the years 1967-1973.

The tenability of the hypotheses was tested through the use of intercorrelation, factor analysis, and analysis of
variance procedures. The .05 level of significance was required to reject the null hypotheses.

Statistical results indicated that there is a moderate relationship between the subtests of the WISC and the ITPA and a significant relationship between the Auditory-Vocal Association and Auditory-Vocal Automatic subtests of the ITPA and WISC Verbal-Performance discrepancies. The factor analysis procedure resulted in the following four factors: (1) Visual Comprehension and Comprehension of Symbols, a factor with loadings from both the WISC and ITPA; (2) Visual Analysis, which was heavily loaded by WISC Performance subtests; (3) an ITPA Memory and General Linguistic factor; and (4) Verbal-Symbolic Retention, a factor which was dominated by WISC Verbal subtests.

On the basis of the findings of this study the following conclusions were drawn:

1. There is a moderate degree of overlap in the traits measured by the WISC and the ITPA.

2. The ITPA Auditory-Vocal Automatic and WISC Mazes are the only subtests of the two tests that are interchangeable.

3. WISC Verbal-Performance discrepancies can be used to predict rather consistent differential performances on the subtests of the ITPA which tap verbal, language, and auditory perceptual skills, that is, those subtests in the Auditory-Vocal Channel, especially the Auditory-Vocal Automatic and the Auditory-Vocal Association subtests.
The major recommendation based on the findings of this study was that in a psychoeducational appraisal of a child with suspected learning disabilities, the WISC should be given in its entirety in order to obtain a measure of the child's general intellectual functioning. If the child fails to respond near age level on a majority of the subtests, then the ITPA should be administered in order to pinpoint specific assets and liabilities.
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CHAPTER I

INTRODUCTION

With increasing regularity, teachers are confronted with children who make poor grades yet have adequate scores on intelligence tests. These children respond neither to pressures to "work up to capacity" nor to increased efforts by the teacher to bring them up to grade level. The inferior performance of some of these children can be seen to stem primarily from cultural impoverishment or emotional stresses. Other children, who appear to have the necessary assets for success in school yet are failing or doing very poorly in one or more of the basic academic skills, are being recognized by educators as forming the heterogeneous group usually termed children with specific learning disabilities. Despite having been the subject of a dozen or more recent books and the area of concentration of two new journals (Journal of Learning Disabilities and Academic Therapy Quarterly), these children are still the subject of much debate, and there is little agreement concerning diagnosis, remediation, or etiology.

In the wake of this controversy there has come a tremendous need for instruments which will yield a more precise analysis of the assets and liabilities of children with specific learning disabilities, with the ultimate aim of
developing diagnostic subcategories and tailoring specific programs of remediation for children with these assessed deficits. As a result of this need for more precise tests, older instruments, such as the Wechsler Intelligence Scale for Children (WISC), are being re-examined to determine their usefulness in diagnosing learning disabilities \((1, 2, 4, 10, 11, 17)\), and newer instruments, such as the Illinois Test of Psycholinguistic Abilities (ITPA) are being devised and their usefulness studied \((3, 8, 9, 15, 22)\).

The complementary nature of the WISC and the ITPA is assumed by counselors, psychologists, and educational diagnosticians, who use both of these tests to assess learning disabled pupils. A number of studies have been conducted dealing with the extent to which the WISC and the ITPA assess common and unique factors, and justifying their joint use \((5, 6, 7, 12, 13, 14, 16)\). The findings of these researchers are often contradictory or based upon an exceedingly small sample, however, and there remains a need for research on the combined use of the WISC and the ITPA, particularly with learning disabled populations. The question as to whether the WISC and the ITPA need to be given in their entirety or whether the two instruments can be combined to save time and avoid needless duplication also remains unanswered.

It is the intent of this study to extend the diagnostic utility of the WISC and the ITPA with children possessing
learning disabilities. As a result of this study, counselors, psychologists, and educational diagnosticians should be able to use these two instruments more efficiently and to interpret their results with increased clarity and certainty.

Statement of the Problem

The problem of this study concerned (1) the relationships that exist between the subtests of the WISC and the ITPA, and (2) whether the mean ITPA subtest scores of those subjects with High Verbal-Low Performance scores on the WISC differ from the mean ITPA subtest scores of those subjects with High Performance-Low Verbal scores on the WISC.

Purposes of the Study

The purposes of this study were (1) to investigate the relationship between the subtests of the WISC and the ITPA, thereby indicating possible areas of overlap in traits measured by these tests; and (2) to investigate whether High Verbal-Low Performance (HV-LP) scorers on the WISC score significantly higher on certain ITPA subtests than High Performance-Low Verbal (HP-LV) scorers, and whether HP-LV scorers on the WISC score significantly higher on certain other subtests of the ITPA.

Hypotheses

The following hypotheses were tested in this study:

I. There is no significant relationship between scores on subtests of the WISC and scores on subtests of the ITPA.
II. There is no significant difference in the means of the ITPA subtest scores of the WISC High Verbal-Low Performance group (HV-LP) and the WISC High Performance-Low Verbal group (HP-LV).

A. The mean of HV-LP on the Auditory Vocal Association subtest of the ITPA will not be significantly higher than that of HP-LV.

B. The mean of HV-LP on the Auditory Decoding subtest of the ITPA will not be significantly higher than that of HP-LV.

C. The mean of HV-LP on the Vocal Encoding subtest of the ITPA will not be significantly higher than that of HP-LV.

D. The mean of HV-LP on the Auditory-Vocal Automatic subtest of the ITPA will not be significantly higher than that of HP-LV.

E. The mean of HV-LP on the Auditory Vocal Sequencing subtest of the ITPA will not be significantly higher than that of HP-LV.

F. The mean of HP-LV on the Motor Encoding subtest of the ITPA will not be significantly higher than that of HV-LP.

G. The mean of HP-LV on the Visual Motor Association subtest of the ITPA will not be significantly higher than that of HV-LP.

H. The mean of HP-LV on the Visual Decoding subtest of the ITPA will not be significantly higher than that of HV-LP.
I. The mean of HP-LV on the Visual-Motor Sequencing subtest of the ITPA will not be significantly higher than that of HV-LP.

Significance of the Study

Increasing amounts of funds and efforts are being expended to clarify some of the complexities involved in the area of specific learning disabilities. Greater and greater numbers of children who are academically inadequate are being assigned to the heterogeneous group of children with learning disabilities. Yet diagnosis of specific abilities and disabilities and remediation of these difficulties is still in an infant, experimental stage. Classificatory instruments, such as the WISC, which have been used for years, are having new demands placed upon them, and new diagnostic measures, such as the ITPA, are being required to demonstrate their reliability, validity, and effectiveness in suggesting remediation. In the interest of improved accuracy and efficiency in the use of the WISC and the ITPA in diagnosing and planning remediation for learning disabilities, studies have been conducted analyzing the degree to which the two tests assess common and unique factors. A survey of these studies indicated considerable confusion and contradiction in their findings and emphasized the need for further research into the relationship between the WISC and the ITPA. Furthermore, there was evidence that the difference between Verbal and Performance IQ's on the WISC bore a significant relationship
to various educational, racial, emotional and cultural problems, including the issue of learning disabilities. No known studies have been reported, however, which deal with WISC Verbal-Performance discrepancy scores and their relationship to the subtests of the ITPA. The present study is unique in that it attempts to contribute clarification to earlier contradictory research and to study relationships between the WISC and the ITPA upon which there is no literature currently available.

Definition of Terms

For the purposes of this study High Verbal-Low Performance scores (HV-LP) were defined as those scores on the Wechsler Intelligence Scale for Children (WISC) in which the Verbal Scale IQ is at least fifteen points higher than the Performance Scale IQ. High Performance-Low Verbal scores (HP-LV) were defined as those scores on the WISC in which the Performance Scale IQ is at least fifteen points higher than the Verbal Scale IQ. Wechsler (20) indicated that a difference of fifteen IQ points between the Verbal and Performance IQ's may be interpreted as being "diagnostically significant", and Seashore (18), after examining the 2200 cases in the WISC standardization sample, found that only one-fourth of the cases showed differences of fifteen points or more between their Verbal and Performance IQ's. Verbal equals Performance (V=P) scores were defined as those scores on the WISC in which the Verbal Scale IQ and Performance Scale IQ
are within eight points of each other. According to Seashore (18), approximately one-half of the cases should show differences of eight points or less.

Limitations of the Study

This study was limited to those pupils who were referred to the Pupil Appraisal Center, North Texas State University, Denton, Texas, during the school years 1967-1973. Another limitation was that all of the subjects were drawn from the limited geographical area of Denton County and neighboring counties. Caution should be exercised in assuming generalization to samples drawn from dissimilar populations, especially normal (or non-referred) populations.

Basic Assumptions

For the purposes of this study it was assumed that the sample of subjects referred to the Pupil Appraisal Center, North Texas State University, Denton, Texas, for lack of academic achievement is typical of all children referred for similar reasons for psychoeducational appraisal.

This study of the WISC and the ITPA was also based on an assumption that they both assess perceptual, conceptual, lingual, associative and retentive abilities. It was also assumed that both tests require visual and aural reception of stimuli and vocal and motor expressions of response.
Treatment of the Data

In order to test the tenability of Hypothesis I, the WISC and the ITPA subtest and total scores of all of the subjects were intercorrelated and a test of the significance of these correlations was made (19). The intercorrelations of the subtests were then factor analyzed by means of the principal components method. The number of factors extracted was limited to those with latent roots greater than unity. The resultant factors were then rotated to Varimax criterion.

In order to determine the tenability of Hypothesis II, the data for each of the subtests of the ITPA were analyzed through an analysis of variance procedure with the three kinds of WISC Verbal-Performance discrepancies (HV-LP, HP-LV, and V=P) as levels of the factor. Where analysis of variance indicated significant differences (F values), a test of the significance of the difference between the means of the scores of any two of the kinds of Verbal-Performance discrepancies as suggested by Winer (21, pp. 65-69) was employed. The .05 level of significance was required to reject the null hypotheses.
CHAPTER BIBLIOGRAPHY


CHAPTER II

REVIEW OF THE LITERATURE

The empirical data pertinent to this research are presented in five sections: (1) discussion of specific learning disabilities, (2) studies related to the Illinois Test of Psycholinguistic Abilities (ITPA) and diagnosis and remediation of learning disabilities, (3) studies pertaining to the Wechsler Intelligence Scale for Children (WISC) and diagnosis of learning disabilities, (4) investigations of the extent to which the WISC and ITPA subtests assess common and unique factors, and (5) studies pertaining to the relationship of WISC Verbal-Performance discrepancies to learning disabilities.

Specific Learning Disabilities

There are a number of children who are not deaf, not blind, not mentally retarded, but who appear to be unable to learn under ordinary school instruction. These children form a complex heterogeneous group classified as "learning disabled". The term "learning disability" has been defined in different ways depending upon the emphasis of the author. The National Advisory Committee for the Handicapped studied this problem and formulated the following widely accepted definition:

Children with special (specific) learning disabilities exhibit a disorder in one or more of the basic
psychological processes involved in understanding or in 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 (20, p. 4).

The word "special" or "specific" in this definition indicates that the child has a definite retardation in one or more areas but that this retardation is not caused by a sensory deficit or severe mental retardation, nor is it due to lack of educational experience. The word "special" or "specific" also indicates that the child may have difficulties only in certain areas, and that he has good or average abilities in other areas.

There is considerable difficulty in the task of differentiating between specific learning disabilities and other types of handicaps. This difficulty is compounded by the fact that there is often an overlap of handicapping conditions in the same child, with learning disabilities and other handicapping conditions both being present. As Kirk (20) points out, "some children are difficult to classify because (a) they have both a learning disability and another identifiable exceptionality" (such as the child who is emotionally disturbed in addition to having a learning disability); or "(b) they have a learning disability which sometimes misclassifies them as having a traditional form of exceptionality"
An example of the latter is the child who is misclassified as mentally retarded because of a low score on intelligence tests, but who, upon more intensive assessment, is found to have normal abilities in some areas and very deficient abilities in other areas. The complexities surrounding specific learning disabilities obviously necessitate maximum efficiency in the use of widely administered tests as well as selective administration of measures designed to pinpoint needed remediation.

Since the beginning of the century psychologists have been actively engaged in the development of measuring instruments to assess intelligence. The purpose of many of these tests has been primarily to classify individuals for placement purposes. The WISC is a familiar example of a test traditionally used for classification and placement.

Counselors, psychologists, and educational diagnosticians have found, however, that simply classifying children in nominal categories is of limited value. In dealing with the heterogeneous group of children with specific learning disabilities it has been necessary to devise formal or informal methods of evaluation whose purpose is the delineation of abilities and disabilities and the suggesting of instructional materials to ameliorate deficits in psychological abilities and academic achievement. Tests for specific functions that give clues to remediation, such as the ITPA, have been developed. Older classificatory tests, such as the
WISC, are being re-examined in order to determine what specific information about abilities and disabilities and what indications for remediation can be gleaned from subtest scores.

The ITPA and Diagnosis and Remediation Of Learning Disabilities

A number of studies have been reported which have dealt with the diagnostic utility of the ITPA and its usefulness in suggesting remediation in specific areas. Hirshoren (12) conducted a comparative study of the predictive validity of the Revised Stanford-Binet and the ITPA. He administered the ITPA and the California Achievement Tests to sixty-six second grade children who two years earlier had been tested with the ITPA and the Revised Stanford-Binet. Analysis of the results was accomplished by correlational methods, including step-wise multiple correlation, and appropriate tests of significance. The resulting data indicated that the Total Language Score of the ITPA is at least as valid a predictor of school achievement as is the Binet IQ, and the ITPA has the advantage by noting specific areas of language deficit so that remedial programs for individual children may be developed. Hirshoren concluded that "Based on a child's performance on the ITPA, it appears possible to construct programs to prevent learning disabilities and the concomitant school failure . . . and to construct remedial programs for the correction of learning disabilities" (12, p. 123).
Several studies have been reported showing beneficial effects of remediation indicated by ITPA scores on learning deficits. Smith (35), Hart (11), Blessing (3), Wiseman (39), Painter (28), DiLorenzo and Salter (6), and McConnell, Horton and Smith (25) and Jorstad (16) conducted studies using matched groups to examine the effects of remediation on psycholinguistic development. In each instance significant gains in psycholinguistic skills were made by experimental groups in comparison with the controls. The study conducted by Wiseman (39) is somewhat representative of the other studies mentioned. Wiseman tutored an experimental group of ten educable mentally retarded children who had been chosen at random from ten pairs of boys matched in disabilities. Boys in the experimental group were tutored individually in their specific areas of psycholinguistic deficit for a six-month period and compared to the control group which attended the same classes but did not receive tutoring in their areas of deficit. The results indicated that the experimental group showed substantial and significant gains in their areas of deficit, the areas emphasized during the tutoring sessions, but no significant gains in their areas of asset. The control group, however, made no significant gains in any area during the same period.

Hart (11) found that there is a positive transfer effect to performance in other areas from teaching children the skills measured by the ITPA. He found that his experimental
group of cerebral-palsied children responded to psycholinguistic remediation not only by showing considerable improvement in ITPA performance but also by achieving a significantly higher reading level at the end of the period of remediation, despite the fact that they had had no special tutoring in reading itself.

A study which particularly emphasized the usefulness of the ITPA in suggesting remediation in specific areas was that of Jorstad (16). Jorstad selected the ITPA in preference to the WISC because the latter "does not lend itself as readily to direct differential diagnosis and remediation of reading disabilities" and "it cannot be used as conveniently to discover the child's relative psycholinguistic strengths and weaknesses" (16, p. 144). She administered the ITPA to twenty Mexican-American students with a mean age of eight years who were having severe reading difficulties. She found that all of the points falling below the average on the composite profiles of all of the students' mean scores were in auditory areas, specifically the Grammatic Closure, Auditory Closure, Auditory Association, Auditory Reception, Sound Blending, and Auditory Memory subtests. Jorstad praised the ITPA for its usefulness in pinpointing these areas of deficit and suggesting subsequent remediation. Rice and Doughtie (30) drew similar conclusions following a case study of a Negro boy who had been classified by his Stanford-Binet IQ of 69 as mentally deficient, but who, following testing with the
ITPA and remediation in the specific areas of deficit indicated was re-classified as normal with an IQ of 98.

Smith (35) studied the effects of a group language development program upon the psycholinguistic abilities of educable mentally retarded children. The subjects consisted of sixteen pairs of educable children who were matched in terms of chronological age and total language age as measured by the ITPA. The subjects, who ranged in age from seven to ten years, had a Binet IQ in the fifty to eighty range and were enrolled in a public school class for educable children. Each of the subjects was administered the ITPA before and after an eleven week remediation program in which they were trained in groups of eight for three forty-five minute periods weekly. The effects of the experimental language program were measured by the mean difference in gain in ITPA total language age for the matched pairs. The results indicated that whereas the experimental group gained 6.75 months in mean language age during the thirty-three session program, the control group showed a loss of .44 months. Smith judged this difference to be highly significant. A year later, Mueller and Smith (27) conducted a follow-up study of the two groups. They found that there were no longer significant differences between the groups, and they suggested that a longer training period may be necessary to obtain permanent gains.
The bulk of the research on the ITPA has utilized the experimental edition, published in 1961, rather than the revised edition, published in 1968. Preliminary findings (20, 36), however, suggest that parallel research using the two editions points to similar conclusions. Waugh (36) administered selected subtests of the experimental and revised editions to thirty six-year-old subjects. Correlations between subtests of the two editions were found to be of the same general magnitude as test-retest coefficients reported for the subtests of each edition. Waugh concluded that "the experimental and revised editions probably could be used interchangeably for most purposes" and that performance on one edition of the ITPA may be compared with performance on the other (36, p. 238).

The WISC and Diagnosis of Learning Disabilities

Studies that have been reported which deal with the WISC and the diagnosis of learning disabilities are generally concerned with the distinctive subtest pattern on the WISC of children with learning disabilities, rather than with the usefulness of the WISC in suggesting remediation. This difference in emphasis is consistent with the traditional view of the WISC as a classificatory instrument. Altus (2), Hopkins and Michael (14), Ackerman, Peters, and Dykman (1), and Bush and Mattson (4) centered their interest on the use of the WISC as an indicator of the strengths and weaknesses of children with specific learning disabilities. The results
of all of these studies indicated that learning-disabled children show erratic and significant deviations in the subtest scores Information, Arithmetic, and Digit Span when compared to normals. Ackerman, Peters, and Dykman (1) administered the WISC to eighty-two elementary school boys diagnosed by a team composed of a child psychiatrist, social worker, psychologist, and an educational specialist as having learning disabilities (CLD) and to thirty-five academically adequate boys (controls). The results of an analysis of variance indicated that the scores of the CLD group were reliably lower than those of controls on the Information, Arithmetic, Similarities, and Digit Span subtests. Using a discriminant function, the authors concluded that five selected WISC subtests could be used as reliably as ten to separate controls from CLD (seventy-six per cent accuracy): Information, Comprehension, Arithmetic, Digit Span and Block Design. Discriminant analyses using the ten WISC subtests did not reliably separate (1) severely disabled readers from mildly disabled readers, or (2) severely disabled readers from adequate readers with other learning disabilities. Of the studies dealing with the WISC mentioned, only that of Ackerman, Peters, and Dykman (1) stated the aim of using the data yielded by the WISC in tailoring specific programs of remediation for children with the assessed deficits, yet the feasibility of such a goal was implied in the results of all of the studies.
The WISC and ITPA Assessing Common and Unique Factors

There have been several studies reported which deal with the question of the extent to which the WISC and the ITPA subtests assess common and unique factors. In general, the findings of studies conducted by Keene (17), Garms (8), Grief (10), Huizinga (15), Polley (29), and Leton (22) indicated that the WISC and the ITPA measure somewhat the same dimensions of intellectual processes and that their joint use is justified. Leton (22) conducted a factor analytic study of ITPA and WISC scores of ninety-two children designated as "learning disabled" following an examination by a pediatrician, a child psychologist, a neurologist, a speech and language specialist, and a social worker. The children ranged in age from five years one month to thirteen years nine months. The twenty subtests in the WISC-ITPA profiles were intercorrelated. The correlation matrix was factor analyzed by means of principal components analysis. Seven factors with eigenvalues greater than 1.0 were extracted. Only two of the factors were exclusive instrument factors. Leton designated factor I as primarily an ITPA auditory-vocal factor, and factor VII as a WISC verbal intelligence factor. Factor II supported an interpretation of motor-associative ability independent of auditory-vocal association as identified in factor I. The independence of memory and sequencing abilities was indicated in factors IV and V. Factor VI was identified as logical reasoning. Leton concluded that "the
correlation and factor matrix provide evidence of their common structure and justify their joint use" (22, p. 36). He interpreted his data as supporting the notion that each of the WISC and ITPA subtests does not assess a different dimension of ability, and suggested that his data indicated that the two tests be used together to measure the same kinds of abilities.

Garms (8), in the report of his factor analysis of the WISC and the ITPA, went one step further than Leton in his conclusions, maintaining that because his data suggested that the WISC and ITPA measure somewhat the same dimensions that it would be a waste of time to administer the ITPA when WISC scores are available. Like Leton, Garms factored the WISC and ITPA subtests by a principal components solution with a varimax rotation of the factor matrix. Unlike Leton, Garms extracted only two factors, one composed of the ability to abstract and integrate and the other including learning of a nonverbal nature. He reported no exclusive instrument factors, and his data resulted in different factor loadings than did Leton's. One reason for this discrepancy may be that Garms' population consisted of only nineteen children and included children with psychiatric as well as organic problems.

In a separate study, Garms (9) correlated the subtests of the WISC and the ITPA of seventeen children between six and nine years who were referred to a community guidance center because of academic failure. The results of the
correlation indicated that Auditory Decoding correlates highest with Digit Span (.87), Vocabulary (.35), Arithmetic (.35), and Picture Arrangement (.32); Visual Decoding correlates highest with Picture Completion (.39), Vocabulary (.29), Information (.25), and Block Design (.24); Auditory Vocal Association correlates highest with Similarities (.48), Vocabulary (.44), Information (.37), and Picture Completion (.31); Visual Motor Association correlates .21 with Picture Arrangement; Vocal Encoding correlates highest with Picture Completion (.35), Block Design (.25) and Vocabulary (.23); Motor Encoding correlates highest with Digit Span (.47) and Similarities (.33); Auditory Vocal Automatic correlates highest with Information (.62), Vocabulary (.51), Comprehension (.34), Arithmetic (.36), and Similarities (.30); Auditory Vocal Sequential correlates highest with Digit Span (.37) and Block Design (.34); and Visual Motor Sequential correlates highest with Similarities (.56), Arithmetic (.50), Block Design (.37), and Vocabulary (.35). Despite the fact that his extremely small population made it necessary for correlation coefficients to reach .482 before they could be considered significant, Garms, like Leton, concluded that the correlations he found reflect overlap in traits tapped by the WISC and ITPA. As in his factor analytic study, Garms concluded that there appears to be little need to administer both the total WISC and the total ITPA. Garms' study, though flawed, does indicate a need for further study with a larger
population into the relationships among the subtests of the WISC and the ITPA.

Keene (17) conducted a factor analytic study the purpose of which was to determine the common and unique factors assessed by the five Frostig Developmental Test of Visual Reception (DTVP) subtests, the nine ITPA subtests, and the twelve WISC subtests. He administered all of these tests to fifty-two first graders drawn in a random stratified manner based on paternal education levels. Like Leton (22) and Garms (8), Keene obtained intercorrelations of the subtests. Each of the three batteries was separately and then simultaneously subjected to principal-axes factor analysis followed by varimax rotation. Only those factors having eigenvalues greater than 1.0 were rotated. Unlike Leton and Garms, Keene found that the ten correlations between the total standard scores of the three tests indicated that the DTVP and ITPA are assessing intelligence as measured by the WISC only to a moderate degree. He found the intercorrelations and overlap of the three tests to be limited almost exclusively to the WISC Performance Scale. The rotated factor analysis of all twenty-six variables resulted in one quasi-unique and eight common factors, only two of which were significantly loaded by variables from more than one of the three batteries, and the nature of these two factors was considered obscure.
Other studies of the relationship of the WISC to the ITPA reported similarly contradictory findings. Examples of this contradiction were found in the studies of Polley (29) and Grief (10). Polley (29) administered the ITPA and the WISC to 160 students in grade levels one through three who had been referred because of suspected or indicated learning disability. Intercorrelation for all the subtests and the part and total scores of each test battery were calculated using a thirty by thirty matrix of scale scores. The results of the correlation indicated that the channels of communication of the ITPA and the Verbal and Performance scales of the WISC seem to be sampling different abilities as indicated by the low correlations recorded for the subjects of this study. Grief (10) administered the WISC and the ITPA to 301 elementary children enrolled in a program for children with learning disabilities. Both the raw scores and scaled scores were subjected to canonical correlation. The results indicated that interrelationships between specific abilities measured on the ITPA and intelligence appear to exist. Therefore, although studies have been reported which attempted to correlate the WISC and the ITPA and to discover their common and unique factors, the degree of confusion and contradiction among their various findings would appear to justify further research into the relationships between the WISC and the ITPA.
The Relationship of WISC Discrepancies To Learning Disabilities

A number of researchers have studied the differences between Verbal and Performance IQ's on the WISC (WISC V-P discrepancies) and their relationship to several factors, including acting out behavior (5), reading (2), neurological deficits (13), personality traits (33, 34), and learning disabilities (31). Shinagawa (34) analyzed WISC V-P discrepancies with an assumption that they were related to personality traits, not only of abnormal but also of normal children. He administered the WISC to 3100 children who had been referred to a psycho-educational clinic and to 603 "unselected" kindergarten children (controls). Discrepancy scores (Verbal IQ minus Performance IQ) were then obtained from each child. These scores were distributed by ten point intervals, and the discrepancy distribution of each group was compared. The data indicated that whereas the controls showed no dominance either in Verbal or in Performance IQ, the referred population showed different types of discrepancy distributions. Shinagawa concluded that since different patterns of personality traits show peculiar types of discrepancy, then intelligence structure has relationship with personality traits.

Holroyd and Wright (13) conducted a study to test the hypothesis that a large V-P discrepancy is an indicator of brain injury. Subjects for this study were selected from
a population of pediatric and child psychiatric patients whose mean Full Scale IQ was average. The criterion group included children whose V-P discrepancy on the WISC was twenty-five IQ points or more. The control group was matched to the experimental group except that their V-P discrepancies were nine points or less. Children in both groups were evaluated for evidences of brain injury by an extensive battery of tests and devices usually employed as a basis for diagnosis. The results indicated that one would be correct in two-thirds of the cases in predicting brain defect when the WISC Verbal IQ is twenty-five points or more higher than the Performance IQ, and only one-fifth of the time when the V-P discrepancy is less than ten points in either direction. The results further indicated that brain injury was not identified in subjects whose Performance IQ was twenty-five points or more higher than their Verbal IQ. These subjects were similar to the control group. From these results, the conclusion may be drawn that the examiner should be alert to the possibility of the existence of mental disorders in subjects whose results on the WISC show a pronounced difference between Verbal and Performance scores.

Lutey (23) drew this same conclusion, as well as several others about the relationship of WISC V-P discrepancies to various educational, racial, emotional, and cultural problems, in her review of studies of WISC V-P discrepancies. Lutey reviewed studies involving a variety of groups of subjects,
including studies cited by Wechsler (37). She concluded that
(1) the odds are in favor of mentally retarded subjects scor-
ing a higher Performance than Verbal IQ; (2) the odds are
even greater that both mentally retarded and normal subjects
from bilingual backgrounds will obtain higher Performance
than Verbal IQ's; (3) subjects having higher levels of edu-
cation will score higher Verbal than Performance scores;
(4) the odds are that Verbal greater than Performance dif-
ferences are more frequent among subjects from higher than
lower socioeconomic levels; (5) among delinquent, sociopathic,
or psychopathic subjects the Performance IQ is likely to be
significantly higher than the Verbal IQ; (6) poor readers
tend to score significantly lower Full Scale and Verbal IQ's
than matched groups of average and/or good readers; (7) a
V-P discrepancy of sixteen points or more, combined with one
or more of Wechsler's other diagnostic signs for schizophre-
nic does aid identifying these children; and (8) children
who exhibit learning problems and score higher on the Verbal
than Performance scale may have perceptual difficulties basic
to the learning problems.

The results of the study conducted by Ackerman, Peters,
and Dykman (1), which was discussed above, also contained
indications pertaining to the information that can be gained
from WISC V-P discrepancies. The results of this study of
children with learning disabilities (CLD) and academically
adequate controls indicated that while a discrepancy between
WISC Verbal and Performance IQ's of fifteen points or more was somewhat more frequent in the CLD group, the significance generally attributed to this discrepancy should be tempered by a consideration of the absolute level of functioning on the two scales separately. Where both Verbal and Performance IQ's were high, the child was likely to be a good reader whatever the direction and degree of dominance. Where the Verbal score was high and the Performance score low, the child was likely to be an adequate but not excellent reader. Where the Performance score was moderate to high and the Verbal score low, the child was likely to be a poor reader. Both scores were found to contribute in that the child needs integrity in both domains, but the Verbal score appears more important for predicting reading success. Of the forty severely disabled readers, only five had Verbal IQ's as high as 110. From this sampling of the literature related to WISC V-P discrepancies, it becomes apparent that there is a wealth of information that can be drawn from examination of the difference between children's Verbal and Performance scores. There is definite evidence that the discrepancy between the Verbal and Performance IQ's has special diagnostic and prognostic value.

No known studies have been reported pertaining to the relationship of WISC V-P discrepancies and the subtests of the ITPA. Rourke, Young, and Flewelling (31), however, conducted a study of the relationship between WISC V-P
discrepancies and various verbal, auditory-perceptual, visual-perceptual, and problem solving abilities in children with learning disabilities. The results of this study, because of the complementarity of the instruments used to the ITPA, were highly suggestive of the results that might be obtained from a study of the relationship of V-P discrepancies and the ITPA. Rourke, Young, and Flewelling, using one-way analysis of variance, compared the means of a group of children whose Verbal IQ's (VIQ) were at least ten points higher than their Performance IQ's (PIQ), called the HV-LP group, with the means of children whose PIQ were at least ten points higher than their VIQ, called the HP-LV group. The ninety subjects were selected from a group of 600 subjects with learning disabilities who had received an extensive battery of neuropsychological tests. As expected, the performance of the HV-LP group was superior to that of the HP-LV group on those tasks that involved verbal, language and auditory-perceptual skills (three subtests of the Wide Range Achievement Test, Halstead-Wepman Aphasia Screening Test, Halstead Speech Perception Test, and the Seashore Rhythm Test). The performance of the HP-LV group was, as expected, superior to that of the HV-LP group on tasks that primarily involved visual-perceptual skills (Trail Making Test and Target Test).

The findings of Polley (29) were complementary to Rourke, Young, and Flewelling's results in that these findings indicated that the Auditory-Vocal Channel of the ITPA
(which includes the Auditory Vocal Association, Auditory Decoding, Vocal Encoding, Auditory-Vocal Automatic, and Auditory Vocal Sequential subtests) correlated significantly higher with the WISC Verbal Scale than with the WISC Performance Scale. Since the Auditory-Vocal Channel consists of tasks that involve verbal, language, and auditory perceptual skills (20), it was hypothesized that subjects in the HV-LP group would do better on some or all of the subtests in the Auditory-Vocal Channel than would the HP-LV group. Although Polley's results indicated that the correlations between the Visual-Motor Channel of the ITPA (which includes the Motor Encoding, Visual Motor Association, Visual Decoding, and Visual-Motor Sequential subtests) and the Verbal and Performance Scales of the WISC were not significantly different, this did not preclude the possibility that the HP-LV group would do better on some of the subtests in the Visual-Motor Channel than would the HV-LP group. This possibility was strengthened by the fact that the subtests in the Visual-Motor Channel involved visual-perceptual skills similar to those on which Rourke, Young, and Flewelling's HP-LV group did significantly better than the HV-LP group (20).

Synthesis

Considerable vagueness and complexity surround the problem of diagnosing and planning remediation for the
heterogeneous group of children with specific learning disabilities. Learning disabilities are difficult to diagnose and remediate for a number of reasons, including inexactitude of available instruments and the fact that there is often an overlap of handicapping conditions in the same child. Such classificatory tests as the WISC have been used extensively for labeling and placement purposes, but specialists working with learning-disabled children have found that simply classifying children in nominal categories is of limited value. Instruments such as the ITPA, whose purpose is the delineation of specific abilities and disabilities and the suggesting of instructional materials to ameliorate the designated deficits, have therefore been devised. These newer instruments lack the established reliability and validity of the older classificatory instruments, and are administered with greater difficulty and less often. It therefore behooves counselors, psychologists, and educational diagnosticians to make use of such commonly administered tests as the WISC with the utmost efficiency, ascertaining their overlap with such diagnostic instruments as the ITPA and judging how such measures can effectively be used in combination.

Most of the available studies pertaining to the ITPA and its effectiveness as a tool for diagnosing and remediating learning disabilities related to psycholinguistic skills reported generally favorable results of remediation suggested by ITPA scores. A variety of subjects, including
retarded, cerebral-palsied, minority and bilingual children, showed significant improvement in their indicated areas of deficit as compared to controls who received no remediation. Although follow-up studies did not show this improvement to be lasting, there is still considerable evidence that the ITPA is effective in achieving its purpose of pinpointing and suggesting remediation for specific deficits.

Of the great volume of research related to the WISC, very little has been reported dealing with the potential of the WISC for suggesting remediation for specific learning disabilities. Several researchers have explored the usefulness of the WISC in diagnosing certain learning problems. The results of these studies indicated that the subtests of the WISC can be helpful in differentiating children with a learning disability from normals, and pointed to the need for further research into the usefulness of the WISC and its part and total scores in both pinpointing difficulties and planning their remediation.

Several studies have been reported which analyzed the extent to which the WISC and the ITPA subtests assess common and unique factors. The results of these studies were somewhat contradictory, with some researchers concluding that the WISC and the ITFA do measure somewhat the same dimensions of intellectual processes, and others judging the degree of overlap between the parts of the two tests to be so slight as to be nonsignificant. Further research with
larger populations appeared to be called for in order to resolve the questions raised by these studies.

The literature contained a number of studies which dealt with the relationship of WISC V-P discrepancies to several factors, including acting out behavior, reading, neurological deficits, personality traits, and learning disabilities. The results of the great majority of these studies indicated a relationship between V-P discrepancies and various educational, racial, emotional, and cultural problems. The existence of this relationship emphasized the potential usefulness of V-P discrepancies in diagnosing and suggesting remediation for learning disabilities and indicated the need for further research into V-P discrepancies. Research pertaining to the relationship of WISC V-P discrepancies and the subtests of the ITPA was indicated by the suggestive results of complementary studies and by the fact that no known studies of the relationship of V-P discrepancies to the ITPA could be found.

Summary findings have been presented of studies dealing with (1) learning disabilities, (2) the ITA and diagnosis and remediation of learning disabilities, (3) the WISC and diagnosis of learning disabilities, (4) the extent to which the WISC and ITPA subtests assess common and unique factors, and (5) the relationship of WISC verbal-performance discrepancies to learning disabilities. The present study combined elements of the latter four groups of studies in an attempt to describe and analyze the degree to which the WISC and
ITPA overlap and can be used in combination, and the implications WISC verbal-performance discrepancies have for children's subtest scores on the ITPA. It is assumed that the information gained will contribute to the efficiency of administration and the clarity of interpretation of test batteries given to children with learning disabilities.
CHAPTER BIBLIOGRAPHY


31. Rourke, B. P., Young, G. C., and R. W. Flewelling, "The Relationships Between WISC Verbal-Performance Discrepancies and Selected Verbal, Auditory-Perceptual, Visual Perceptual, and Problem-Solving Abilities in


CHAPTER III

METHODS AND PROCEDURES

This chapter presents in detail (1) a description of the subjects under study, (2) the instruments utilized, (3) the procedures involved in obtaining and processing the data, and (4) the statistical procedures employed in analyzing the data.

Description of the Subjects

The subjects used in this study were all of the pupils who were referred to the Pupil Appraisal Center, North Texas State University, Denton, Texas, during the academic years 1967-1973, who were administered both the Illinois Test of Psycholinguistic Abilities (ITPA) and the Wechsler Intelligence Scale for Children (WISC). There were 132 children who had been administered at least a majority of the ITPA and WISC subtests, and these 132 comprised the population under study. Of the 132, 108 children had been administered the ten major WISC subtests and all of the ITPA subtests. These 108 were further divided into three groups according to their WISC discrepancy scores. These groups were High Verbal-Low Performance (N = 16), Verbal Equals Performance (N = 62), and High Performance-Low Verbal (N = 30). The subjects were all referred by their schools because of lack
of school achievement. The Pupil Appraisal Center is an interdisciplinary service center. Children who are referred to the Pupil Appraisal Center are evaluated by graduate students who are specialists in the areas of psychological, reading, and speech and hearing assessment. If deficits are found, the child is immediately scheduled for remedial therapy in the appropriate area.

The subjects used in this study ranged in age from six years two months to fifteen years four months. The majority of the subjects (fifty-six per cent) were eight through ten years of age, and seventy-eight per cent of the subjects fell in the seven through eleven year range. The age distribution of the subjects appears in Table I.

TABLE I

AGE DISTRIBUTION OF SUBJECTS
(N=132)

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Academically, the subjects ranged from first graders through tenth graders. The grade level distribution of the subjects used in this study appears in Table II. All of the subjects lived in and attended public schools in Denton.
County or neighboring counties. The subjects came from a wide range of social, cultural, and economic backgrounds. Parental employment ranged from unskilled laborers to medical doctors and university professors. The majority (fifty-five per cent) of the subjects came from middle class backgrounds, however, with the fathers employed as proprietors, managers, technicians, officials, farmers, wholesale and retail dealers, skilled workers, and foremen, and the mothers not working outside the home. All but three of the children, who were Negroes, were white. Only twenty-seven of the subjects were female; the remaining 105 were male.

**TABLE II**

**GRADE LEVEL DISTRIBUTION OF SUBJECTS**

(N=132)

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</table>

Upon being referred to the Pupil Appraisal Center by his school principal, counselor, or teacher, each child was administered an extensive battery of psychological and psychoeducational tests in the three areas of counseling, reading, and speech and hearing. The test battery was usually administered in about six hours over a two day period by three different graduate students who had been trained and
supervised in the administration and scoring of the tests administered. The WISC and the ITPA were included in this test battery. These WISC and ITPA scores, which were obtained during the subjects' first contacts with the Pupil Appraisal Center during the period from November, 1967, through June, 1973, are the scores which comprised the test data of the present study.

Description of the Instruments

The Illinois Test of Psycholinguistic Abilities (ITPA) and the Wechsler Intelligence Scale for Children (WISC) were the instruments used in this study. Both the ITPA, which was first published in 1961, and the WISC, first published in 1949, are well-known tests used extensively in both clinical and educational settings.

The development of the ITPA as a comprehensive diagnostic test for pre-school children began as early as 1951, and by 1961 an experimental edition of the ITPA resulted. The background and theoretical basis have been reported by Sievers (14), McCarthy (7), Kirk and McCarthy (5), and McCarthy and Kirk (10), and Kirk (2, 3). After five years of clinical use, work was begun towards putting the experimental edition into final form. The knowledge which had been gained about each of the subtests and the test as a whole suggested certain modifications, but it was believed that the basic design of the test was sound and should be maintained. Over a three year period (1965-1968) the test materials and procedures...
were redesigned and the test restandardized, utilizing whenever possible the effective aspects of the original test. The revised edition of the ITPA was published in 1968. Further details regarding the construction and standardization of the revised edition can be found in Paraskevopoulos and Kirk (13). There is evidence (4, 16) that the two editions of the ITPA can be used interchangeably for most purposes, and that performance on one edition may be compared with performance on the other. Since the subjects in the present study were administered the experimental edition, the reliability and validity data reported will concern that edition.

The ITPA was designed to identify "psycholinguistic abilities in children between the ages of two and one-half and nine" (9, p. 1). It was based on a communication model which was first postulated by Osgood, then revised and adapted by McCarthy (9, pp. 1-13). This model suggested that there are three dimensions of cognitive abilities: (1) levels of organization, (2) psycholinguistic processes, and (3) channels of communication. First, certain psycholinguistic processes seem to require higher levels of organization than do others. In the ITPA, McCarthy and Kirk distinguish two levels, the representational and the automatic-sequential. The representational level involves the subject's perceiving the meaning of a spoken word or visual image and using his repertoire of past experiences to relate such symbols with other stimuli in the given situation. The subject's degree of development
at the automatic-sequential level is demonstrated through his ability to replicate a given auditory or visual sequence.

Three psycholinguistic processes are delineated in the model. These are (1) decoding, or the ability to derive meaning from visual and auditory stimuli, (2) association, or the ability to integrate linguistic symbols internally, and (3) encoding, or the ability to express oneself.

The channels of communication postulated in the model are the routes through which the content of communication flows. These routes include the modalities through which sense impressions are received (input) and the forms of expression through which a response is made (output). The major modes of input are auditory and visual, and the major modes of output are vocal and motor. Complete channels involving these modes of input and output would be auditory-vocal, auditory-motor, visual-motor, and visual-vocal. Because of practical limitations, the ITPA incorporates only the auditory-vocal and the visual-motor channels.

The ITPA was designed as a diagnostic rather than as a classificatory test, and each of its nine subtests was designed to tap a different psycholinguistic ability. The subtests of the revised edition (16) are listed in parentheses next to the subtests of the experimental edition, which are as follows:

**Test 1. Auditory decoding** (auditory reception) involves the ability to comprehend the spoken word and provides
information concerning the child's vocabulary and store of information. The child is asked to answer "yes" or "no" to such questions as "Do cars sleep?".

Test 2. Visual decoding (visual reception) taps the ability to gain meaning from visual symbols, that is, to comprehend pictures and the spoken word. The subject selects related pictures, such as a square table and a round table.

Test 3. Auditory-vocal association (auditory association) involves the ability to relate concepts presented orally. This subtest consists of a series of verbal analogies which the child must complete.

Test 4. Visual-motor association (visual association) tests the ability to relate meaningful visual symbols. The subject must select one of four pictures that "goes with" the stimulus picture.

Test 5. Vocal encoding (verbal expression) taps the ability of the child to express his own concepts vocally. The child is asked to "tell all about" a stimulus object.

Test 6. Motor encoding (manual expression) involves the ability to express ideas manually, or in gestures. The subject is asked to make gestures related to the use of an object represented in a stimulus picture.

Test 7. Auditory-vocal automatic (grammatic closure) tests the ability to predict future linguistic events from past experience (grammar facility). The child is shown a picture and told, "Here is a bed; here are two ____."
Test 8. Auditory-vocal sequencing (auditory sequential memory) taps the ability to reproduce from memory sequences of digits increasing in length from two to eight digits. The child is asked to repeat digits.

Test 9. Visual-motor sequencing (visual association) tests the ability to correctly repeat a sequence of symbols previously seen. The subject must reproduce a sequence by correct ordering of pictures or geometric shapes.

The authors of the ITPA have provided information about the standardization procedures and the statistical characteristics of the test (9). The ITPA was standardized on a population of 1,000 children between the ages of two and nine years from the Decatur, Illinois, public schools. The authors reported a test-retest reliability of .97 (total battery), .73 to .96 (individual subtests), and split-half reliability of .99 (total battery), .90 to .96 (subtests) (9, pp. 31, 33). The authors demonstrated the content validity of the subtests by two means: (1) they reported consistency coefficients of .89 to .95; and (2) they found low to moderate subtest intercorrelations, indicating heterogeneity within the battery (9, pp. 26-27). Concurrent and predictive validity were studied through comparisons between ITPA scores and scores from the Revised Stanford-Binet, three subtests of the Stanford Achievement Test, two subtests of the Durrell-Sullivan Achievement Test, Raven's Progressive Matrices A, Ab, and B, and the Peabody Picture Vocabulary
Test. These concurrent and predictive validity measures were obtained from a sample of eighty-six subjects ranging in age from seven to eight years six months. The median of the nine concurrent validity coefficients was .15; the median of the nine predictive coefficients was .23. The authors reported that these comparisons yielded coefficients of correlation significant at the .01 level. Content validity was demonstrated by a description of the item selection procedures and calculation of subtest homogeneity using the normative data. The internal consistency coefficients for the subtests were about .75 for each age group.

Weener, Barritt, and Semmel (20) have contributed a thorough critique of all of the psychometric characteristics of the ITPA. They concluded that the "ITPA is a fruitful beginning toward the goal of differential diagnosis based on profile analysis" (20, p. 379), but they found that this goal had not yet been reached in the experimental edition of the ITPA because of (1) deficits in the reliability and validity information, (2) a failure of the model to adequately integrate the nine subscales, and (3) a failure of the model to adequately explain the relationship among subscales or between subscale performance and other relative behavior. McCarthy (8) attempted to answer these criticisms in a response to Weener, Barritt, and Semmel. He contended that "one would seek at length to find another interim psychometric device so richly endowed with so much supportive data for practitioners" (8, p. 382).
The WISC, unlike the ITPA, was designed to classify subjects according to a concept of global intelligence, and not to be a series of tests that measure "primary abilities". The theory underlying the WISC is that "intelligence cannot be separated from the rest of the personality, and a deliberate attempt has been made to take into account the other factors which contribute to the total effective intelligence of the individual" (19, p. 5).

The WISC consists of twelve subtests which are divided into two groups labeled Verbal and Performance. Wechsler reported that most of the verbal tests correlate better with each other than with tests of the performance group, and vice versa, but here again he reiterated that the tests were not designed to be factor pure (19, p. 5). Wechsler maintained that each subtest taps other factors than verbal or performance factors, among them non-intellective ones. These factors were postulated to cut across the two main groups to produce other classifications or categories that would also be important to consider in evaluating the individual's performance. The Verbal subtests include Information, Comprehension, Arithmetic, Similarities, and Vocabulary. Digit Span is a supplementary Verbal subtest. The Performance subtests are Picture Completion, Picture Arrangement, Block Design, Object Assembly, and Coding. Mazes is a supplementary Performance subtest.
The **Information** subtest measures the information the child has gained from experience and education. It consists of factual questions which require a short answer.

The **Comprehension** subtest tests the child's practical knowledge and social judgment. It consists of practical questions requiring anticipation and judging consequences to which the child makes a short response.

The **Arithmetic** subtest measures concentration and arithmetic reasoning. The child is required to work a variety of arithmetic word problems.

The **Similarities** subtest taps the child's ability to recognize and describe essential relations between objects or ideas. The child is asked, "In what way are (two objects) alike?"

The **Vocabulary** subtest is a measure of the child's potentiality for dealing with symbols and of the quality and character of his thought processes. It consists of a list of words which the child is asked to define.

The **Digit Span** subtest tests attention and auditory memory and sequencing. The examiner reads increasingly lengthy lists of digits which the child is asked to repeat.

The **Picture Completion** subtest taps visual alertness and organization and the ability to recognize essential details. It consists of a series of pictures which the examiner shows the child and asks him to tell what important part of the picture is missing.
The **Picture Arrangement** subtest measures non-verbal judgment, anticipation and planning through the use of essential picture clues. The child is asked to arrange a series of pictures so that they make a sensible story.

The **Block Design** subtest tests the ability to analyze and reproduce abstract designs. The child is shown a picture of a design and is asked to reproduce the design using colored blocks.

The **Object Assembly** subtest measures the ability to see the relationship of parts to the whole in a familiar configuration. The child is asked to assemble four puzzles as quickly as possible.

The **Coding** subtest taps the child's speed of visual-motor reaction and association of symbols. The child is asked to reproduce geometric figures through the use of a key.

The **Mazes** subtest measures the ability to plan and follow a visual pattern. The child is asked to start in the middle of a maze and draw a route out of it without going through a "wall".

The standardization, reliability, and validity data pertaining to the WISC have become sufficiently well-known and accepted so that the WISC is somewhat of a "benchmark" among psychometric instruments, by which many other tests are validated. Wechsler (19) reported that the WISC was standardized on a sample of 100 boys and 100 girls at each age from five through fifteen years, a total of 2200 cases. The cases were
white children from both rural and urban areas whose fathers were occupationallly distributed similarly to all employed white males. Intercorrelations among the subtests, and among the subtests and the Verbal, Performance and Full Scale Scores were reported for ages seven and one half, ten and one half and thirteen and one half. These latter correlation coefficients ranged from .54 to .90. Wechsler (19) reported reliability coefficients of the individual tests and of the Verbal, Performance, and Full Scale Scores from .50 to .96. These reliability coefficients were computed by the split-half technique, with appropriate correction for full length of the test by the Spearman-Brown formula. As another statement of the stability of WISC scores, Wechsler presented the standard error of measurement by test and age. The standard error of measurement ranged from 1.44 to 2.12 on the subtests, and at around 4.00 for the Full Scale Score. Wechsler (18, 19) has presented his standardization, reliability, and validity data in readable tables for those interested in a detailed description of the statistical characteristics of the WISC.

Procedures for Collecting and Processing the Data

A careful review of the records of the total population referred to the Pupil Appraisal Center during its first five years (1967-1973) of operation was conducted. Background and biographical data and part and total test scores of all those pupils administered both the Wechsler Intelligence Scale for
Children (WISC) and the Illinois Test of Psycholinguistic Abilities (ITPA) were obtained. These data were coded and punched on IBM cards in preparation for their being processed by the IBM 360/50 computer at the Data Processing Center of North Texas State University, Denton, Texas. The data punched included the standard scores of the nine subtests and the total language scores of the ITPA; the standard scores of the twelve subtests of the WISC; and the Verbal, Performance, and Full Scale scores of the WISC. In order to obtain scores which could be statistically compared to the WISC standard scores and across age groups, it was necessary to convert each ITPA subtest raw score to a standard score (ranging in value from a negative three to a positive three, with a mean of zero and a standard deviation of .5) through the use of tables provided by the authors of the ITPA (10). Also, an ITPA total language age score was obtained for each subject through the use of Table A (10, pp. 109-110). Since this table lists language age scores in years and months, it was then necessary to transform these scores into total months (e.g., six years ten months to eighty-two months).

Procedures for Analysis of the Data

Hypothesis I. Means and standard deviations were computed for each of the twelve subtests of the WISC, the Verbal, Performance, and Full Scale scores of the WISC, and the nine subtests and total language scores of the ITPA. The Pearson product-moment correlation coefficients were computed between
each of the subtest, Verbal, Performance, and Full Scale scores of the WISC and each of the subtest and total language scores of the ITPA. A test of the significance of these correlations was then made (15). The intercorrelations of the subtests were factor analyzed by means of the principal components method. The number of factors extracted was limited to those with latent roots greater than unity. The resultant factors were then rotated to Varimax criterion.

Hypothesis II. The data for each of the subtests of the ITPA were analyzed through an analysis of variance procedure with the three kinds of verbal-performance discrepancies (HV-LP, HP-LV, and V=P) as levels of the independent variable. Where analysis of variance indicated significant differences (F values), Fisher t tests were made in order to determine which of the three discrepancy groups differed significantly from each other. The comparisons between the HV-LP and HP-LV groups were the principal comparisons of interest. The statistical analyses involved in both Hypothesis I and Hypothesis II were facilitated by use of the IBM 360/50 computer at the Data Processing Center, North Texas State University, Denton, Texas.
CHAPTER BIBLIOGRAPHY


11. McCarthy, J. J. and James L. Olson, Validity Studies on the Illinois Test of Psycholinguistic Abilities,


CHAPTER IV

STATISTICAL ANALYSIS OF RESULTS AND DISCUSSION

Analysis of Data

The purpose of this chapter is to present and analyze the statistical findings of this study. This study was designed (1) to investigate the relationship between the subtests of the Wechsler Intelligence Scale for Children (WISC) and the Illinois Test of Psycholinguistic Abilities (ITPA), thereby indicating possible areas of overlap in traits measured by these tests, and (2) to investigate whether High Verbal-Low Performance (HV-LP) scorers on the WISC score significantly higher on certain ITPA subtests than High Performance-Low Verbal (HP-LV) scorers, and whether HP-LV scorers on the WISC score significantly higher on certain other subtests of the ITPA. In order to accomplish the former purpose, the subtest and total scores of both tests were intercorrelated and factor analyzed by means of the principal components method. In order to accomplish the latter purpose, the data for each of the subtests of the ITPA were analyzed through an analysis of variance procedure with the three kinds of verbal-performance discrepancies (HV-LP, HP-LV, V=P) as levels of the independent variable. The .05 level of significance was established as the basis upon which the null hypotheses would be rejected. Means and standard deviations for the
distributions of the WISC and the ITPA subtest and total scores are shown in Appendix A and Appendix B.

Hypothesis I

Hypothesis I, stated in the null form, predicted that there would be no significant relationship between scores on subtests of the WISC and scores on subtests of the ITPA. The Pearson product-moment correlation coefficients computed to test this hypothesis are shown in Table III. In this table, the correlation coefficient must equal or exceed .26 to be significant at the .01 level, and the correlation coefficient must equal or exceed .20 to be significant at the .05 level. Exceptions are those coefficients applying to the supplementary subtests Digit Span and Mazes, which, because of fewer scores reported, require correlation coefficients of .39 and .80, respectively, in order to be significant at the .01 level, and coefficients of .30 and .67 to be significant at the .05 level.

It will be noted that a number of the correlation coefficients reached or exceeded the level of confidence established. Therefore Hypothesis I, which stated that there is no significant relationship between scores on subtests of the WISC and scores on subtests of the ITPA, was rejected.

As a further test of the tenability of Hypothesis I, the intercorrelations of the subtests of the WISC and the ITPA were factor analyzed by means of the principal components method. The number of factors extracted were limited to
### TABLE III

**INTERCORRELATION OF WISC AND ITPA SUBTESTS AND TOTAL SCORES**

| Test       | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|------------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Info.*     | 43| 52| 56| 69|--2| 29| 31| 39| 24 | 20 | 69 | 80 | 44 | 71 | 39 | 32 | 52 | 41 | 36 | 35 | 52 | 20 | 22 |
| Comp.*     | 16| 51| 52| 07| 33| 36| 18| 23| 07 | 20 | 72 | 35 | 62 | 37 | 29 | 39 | 27 | 26 | 39 | 34 | 19 | 13 |
| Arith.*    | 38| 43| 25| 18| 31| 36| 25| 28| 63 | 59 | 41 | 57 | 16 | 29 | 28 | 34 | 22 | 24 | 33 | 31 | 26 |
| Simil.*    | 63| 13| 32| 34| 27| 13| 14| 72 | 80 | 38 | 68 | 35 | 30 | 50 | 35 | 33 | 41 | 50 | 34 | 21 |
| Voc.*      | 11| 34| 51| 36| 33| 26| 54| 86 | 55 | 82 | 36 | 37 | 49 | 33 | 37 | 29 | 49 | 26 | 11 |
| Dig. Sp.** | -07| -01| 31| 17| 15| 33| 19| 17| 21| -06| 12| 05| 19| 15| 01| -05| 35| 12 |
| Pic. Comp.*| 39| 34| 33| 18| 54| 40| 65| 58| 23| 39| 36| 29| 28| 39| 35| 23| 14 |
| Pic. Arr.* | 34| 35| 17| 12| 48| 66| 63| 30| 33| 47| 21| 28| 36| 31| 22| 10 |
| Bl. Des.*  | 56| 22| -08| 40| 73| 62| 19| 40| 19| 33| 15| 20| 26| 28| 19 |
| Obj. Ass.* | 38| 31| 33| 76| 60| 24| 36| 21| 39| 15| 21| 16| 30| 18 |
| Coding*    | -42| 24| 57| 44| 13| 23| 12| 24| 09| 25| 08| 27| 21 |
| Mazes***   | 65| 27| 51| 47| 30| 39| 68| 20| 27| 80| 55| -09 |
| VIQ*       | 57| 90| 43| 41| 56| 44| 39| 42| 56| 31| 20 |
| PIQ*       | 87| 34| 50| 39| 45| 27| 40| 35| 38| 25 |
| FSIQ*      | 43| 51| 55| 50| 39| 47| 52| 39| 25 |
| Aud. Dec.* | 56| 56| 37| 44| 30| 52| 34| 31 |
| Vis. Dec.* | 41| 43| 34| 42| 41| 28| 28 |
| Aud-Voc. Ass.* | 42| 58| 46| 61| 33| 36 |
| Vis-Mot. Ass.* | 31| 34| 38| 26| 31 |
| Voc. Enc.* | 31| 46| 20| 35 |
| Mot. Enc.* | 37| 24| 19 |
| Aud-Voc. Auto.* | 44| 35 |
| Aud-Voc. Seq.* | 42 |
| Vis-Mot. Seq.* | 56 |

Decimal points omitted.

*Correlation coefficient of 26 or greater significant at .01 level, of 20 or greater at .05 level, df = 129.

**Correlation coefficient of 30 or greater significant at .05 level, df = 42.

***Correlation coefficient of 67 or greater significant at .05 level, df = 8.
those which had latent roots greater than unity. The four factors which resulted from this procedure were then rotated to Varimax criterion.

The rotated variable loadings, variable communalities, and the eigenvalues (latent roots) and per cent of variance for the four factors are presented in Table IV. The factor loadings for each of the nineteen variables before Varimax rotation are shown in Appendix C.

Factor I is identified as Visual Organization and Comprehension of Symbols. The primary loadings of the Picture Completion and Picture Arrangement subtests define the visual organization requirements in the stimuli, and the ability to anticipate and plan is identified in these two subtests as well as in the Comprehension subtest. The Auditory-Vocal Association and Motor Encoding subtests, and, secondarily, the Vocabulary subtest, define the nature of the comprehension of symbols requirement in the stimuli. These latter three subtests, as well as the Comprehension subtest, involve the subject's perceiving the meaning of a spoken word or visual image and using his repertoire of past experiences to relate such symbols with other stimuli in the given situation.

Factor II is identified as Visual Analysis and is primarily a WISC performance ability. The WISC Coding, Block Design and Object Assembly variables define the nature of this factor. Manifestation of this ability is based on the association of symbols, the perception of figures, and the analysis of figural relationships.
TABLE IV

VARIABLE LOADINGS, COMMUNALITIES AND FACTOR STRENGTHS
IN ROTATED FACTOR METHOD MATRIX

<table>
<thead>
<tr>
<th>Variables</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>h²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information</td>
<td>.24</td>
<td>.15</td>
<td>.22</td>
<td>.78</td>
<td>.74</td>
</tr>
<tr>
<td>Comprehension</td>
<td>.60</td>
<td>.02</td>
<td>.07</td>
<td>.40</td>
<td>.53</td>
</tr>
<tr>
<td>Arithmetic</td>
<td>-.15</td>
<td>.35</td>
<td>.23</td>
<td>.68</td>
<td>.66</td>
</tr>
<tr>
<td>Similarities</td>
<td>.37</td>
<td>.04</td>
<td>.23</td>
<td>.68</td>
<td>.65</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>.41</td>
<td>.21</td>
<td>.08</td>
<td>.74</td>
<td>.77</td>
</tr>
<tr>
<td>Picture Comp.</td>
<td>.64</td>
<td>.39</td>
<td>.09</td>
<td>.07</td>
<td>.57</td>
</tr>
<tr>
<td>Picture Arr.</td>
<td>.59</td>
<td>.33</td>
<td>.03</td>
<td>.28</td>
<td>.53</td>
</tr>
<tr>
<td>Block Design</td>
<td>.17</td>
<td>.71</td>
<td>.08</td>
<td>.28</td>
<td>.61</td>
</tr>
<tr>
<td>Coding</td>
<td>.26</td>
<td>.80</td>
<td>.09</td>
<td>.05</td>
<td>.71</td>
</tr>
<tr>
<td>Object Assembly</td>
<td>.05</td>
<td>.63</td>
<td>.08</td>
<td>.07</td>
<td>.41</td>
</tr>
<tr>
<td>Auditory Decoding</td>
<td>.38</td>
<td>-.00</td>
<td>.62</td>
<td>.16</td>
<td>.56</td>
</tr>
<tr>
<td>Visual Decoding</td>
<td>.43</td>
<td>.37</td>
<td>.39</td>
<td>.08</td>
<td>.49</td>
</tr>
<tr>
<td>Aud.-Voc. Assoc.</td>
<td>.52</td>
<td>-.03</td>
<td>.58</td>
<td>.33</td>
<td>.72</td>
</tr>
<tr>
<td>Vis.-Mot. Assoc.</td>
<td>.22</td>
<td>.38</td>
<td>.43</td>
<td>.22</td>
<td>.43</td>
</tr>
<tr>
<td>Vocal Encoding</td>
<td>.42</td>
<td>-.07</td>
<td>.56</td>
<td>.17</td>
<td>.52</td>
</tr>
<tr>
<td>Motor Encoding</td>
<td>.61</td>
<td>.18</td>
<td>.25</td>
<td>.12</td>
<td>.48</td>
</tr>
<tr>
<td>Aud.-Voc. Auto.</td>
<td>.33</td>
<td>-.01</td>
<td>.60</td>
<td>.42</td>
<td>.64</td>
</tr>
<tr>
<td>Aud.-Voc. Seq.</td>
<td>-.04</td>
<td>.36</td>
<td>.59</td>
<td>.18</td>
<td>.51</td>
</tr>
<tr>
<td>Vis.-Mot. Seq.</td>
<td>-.09</td>
<td>.19</td>
<td>.78</td>
<td>.03</td>
<td>.66</td>
</tr>
<tr>
<td>Eigenvalues</td>
<td>6.96</td>
<td>1.70</td>
<td>1.40</td>
<td>1.13</td>
<td></td>
</tr>
<tr>
<td>% of Variance</td>
<td>36.62</td>
<td>8.89</td>
<td>7.38</td>
<td>5.97</td>
<td></td>
</tr>
</tbody>
</table>
Factor III is identified as an ITPA Memory and General Linguistic factor as postulated by McCarthy and Kirk (12). The primary loadings of the ITPA Auditory-Vocal Automatic, Auditory-Vocal Sequencing, and Visual-Motor Sequencing subtests define the memory requirements of the stimuli. Each of these subtests taps the subject's ability to replicate given auditory or visual sequences. The moderately high loadings of all but two of the other ITPA subtests, including Auditory Decoding, Auditory-Vocal Association, Vocal Encoding and Visual-Motor Association, define McCarthy and Kirk's general linguistic factor, which encompasses the representational and automatic-sequential levels of organization, the psycholinguistic processes of decoding, association, and encoding, and the auditory-vocal and visual-motor channels of communication.

Factor IV is heavily loaded by WISC Verbal subtests and is identified as Verbal-Symbolic Retention. It is similar to Cohen's Verbal Comprehension I. Cohen (3) postulates that this factor reflects verbally retained knowledge from formal education. This factor is defined by several processes, including the retentive memory process as assessed in the Information subtest; cognition of symbolic relations as assessed in the Arithmetic subtest; the abstract reasoning process, or the comprehension of similarities and differences, as assessed in the Similarities subtest; and the cognition of semantics as assessed in the Vocabulary subtest, and secondarily, in the
Auditory-Vocal Automatic subtest. The secondary loading of the Comprehension subtest indicates that this factor may also include the evaluation process.

Hypothesis II

Hypothesis II, stated in the null form, predicted that there would be no significant difference in the means of the ITPA subtest scores of the WISC High Verbal-Low Performance group (HV-LP) and the WISC High Performance-Low Verbal group (HP-LV). Hypothesis II was further stated in the form of nine corollary hypotheses. Each corollary will be discussed separately in terms of statistical significance or non-significance.

HV-LP has been previously defined as those subjects whose IQ scores on the WISC Verbal Scale are at least fifteen points higher than their IQ scores on the WISC Performance Scale. HP-LV has been previously defined as those subjects whose WISC Performance Scale IQ score is at least fifteen points higher than their WISC Verbal Scale IQ. A third group (V=P), in which the Verbal Scale IQ and Performance Scale IQ are within eight points of each other, was also included in the statistical comparisons. The V=P group was expected to occupy an intermediate position between that of the other two groups over all of the dependent measures. It will be noted in Table XV that the mean WISC Full Scale IQ of V=P differs significantly from that of HV-LP and HP-LV. Therefore the p levels for the comparisons involving V=P may be spuriously
high, and the $t$ scores given in the following discussion should be considered with this difference in mind. The principal comparisons of interest, however, are those between the two groups of extreme scores, the HV-LP and HP-LV groups, which did not differ significantly in WISC Full Scale IQ scores.

It was hypothesized in corollary A of Hypothesis II that the mean of HV-LP on the Auditory-Vocal Association subtest of the ITPA would not be significantly higher than that of HP-LV. It can be seen in Table V that the $F$ value is 3.74, a value which is significant at the .05 level.

**TABLE V**

ANALYSIS OF VARIANCE OF MEAN DIFFERENCE IN AUDITORY-VOCAL ASSOCIATION SUBTEST SCORES FOR THREE GROUPS

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>d.f.</th>
<th>Variance Estimate</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>9.33</td>
<td>2</td>
<td>4.66</td>
<td>3.74*</td>
</tr>
<tr>
<td>Within</td>
<td>131.11</td>
<td>105</td>
<td>1.25</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>140.44</td>
<td>107</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

*Significant at .05 level.

In order to determine the direction and magnitude of the differences between the three discrepancy groups, Fisher $t$ tests were made between all possible pairs of means for the three groups. The results of these tests indicated that HV-LP (with a mean of .92) scored significantly higher than
HP-LV ($\bar{X} = .01$) at the .01 level ($t = 2.71$, $df = 44$).

Therefore corollary A of the null hypothesis was rejected.

It was also found that the $t$ ratio for the difference between $V=P (\bar{X} = .23)$ and HP-LV was significant at the .01 level, indicating that those subjects with equal or nearly equal Verbal and Performance scores also score significantly higher than HP-LV on the Auditory-Vocal association subtest.

It was predicted in corollary B of hypothesis II that on the Auditory Decoding subtest of the ITPA the mean of HV-LP would not be significantly higher than that of HP-LV. Inspection of Table VI shows an $F$ value of 2.44, a value which falls short of significance at the .05 level. Therefore the null hypothesis was not rejected.

**TABLE VI**

**ANALYSIS OF VARIANCE OF MEAN DIFFERENCE IN AUDITORY DECODING SUBTEST SCORES FOR THREE GROUPS**

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>d.f.</th>
<th>Variance Estimate</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>4.04</td>
<td>2</td>
<td>2.02</td>
<td>2.44*</td>
</tr>
<tr>
<td>Within</td>
<td>86.99</td>
<td>105</td>
<td>.83</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>91.03</td>
<td>107</td>
<td>...</td>
<td>..</td>
</tr>
</tbody>
</table>

*Not significant at .05 level.*

Although not significant at the .05 level, the obtained $F$ value for corollary B represents significance at the .10 level, suggesting a possible trend. Therefore Fisher $t$ tests
between all possible pairs of means for the three discrepancy groups were made in order to determine which discrepancy groups differed significantly from each other. It was found that HV-LP ($\bar{X} = 1.11$) scored significantly higher than V=P ($\bar{X} = .55$) at the .05 level ($t = 2.20$, df = 76). The difference between HV-LP and HP-LV ($\bar{X} = .69$) represented significance at the .10 level ($t = 1.493$, df = 44). This difference, while not reaching the level of significance necessary for the rejection of corollary B of the null hypothesis, does suggest a trend toward High Verbal scorers scoring higher than High Performance scorers on the Auditory Decoding subtest.

The prediction was made in corollary C of Hypothesis II that the mean of HV-LP on the Vocal Encoding subtest of the ITPA would not be significantly higher than that of HP-LV. The mean scores of the three groups were as follows: HV-LP = 1.15, V=P = .45, and HP-LV = .36. Inspection of Table VII reveals an F value of 1.98. This value is not significant; therefore corollary C of the null hypothesis was not rejected.

It was hypothesized in corollary D of Hypothesis II that the mean of HV-LP on the Auditory-Vocal Automatic subtext of the ITPA would not be significantly higher than that of HP-LV. Examination of Table VIII reveals an F value of 6.84, a value which is significant at the .001 level.

Fisher $t$ tests, which were made in order to determine which of the three discrepancy groups differed significantly
### TABLE VII
**ANALYSIS OF VARIANCE OF MEAN DIFFERENCE IN VOCAL ENCODING SUBTEST SCORES FOR THREE GROUPS**

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>d.f.</th>
<th>Variance Estimate</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>7.49</td>
<td>2</td>
<td>3.74</td>
<td>1.98*</td>
</tr>
<tr>
<td>Within</td>
<td>198.99</td>
<td>105</td>
<td>1.90</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>206.48</td>
<td>107</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Not significant at .05 level.

### TABLE VIII
**ANALYSIS OF VARIANCE OF MEAN DIFFERENCE IN AUDITORY-VOCAL AUTOMATIC SUBTEST SCORES FOR THREE GROUPS**

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>d.f.</th>
<th>Variance Estimate</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>16.08</td>
<td>2</td>
<td>8.04</td>
<td>6.84*</td>
</tr>
<tr>
<td>Within</td>
<td>123.30</td>
<td>105</td>
<td>1.17</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>139.38</td>
<td>107</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significant at .001 level.

...from each other, indicated that HV-LP (\(X = 1.19\)) scored significantly higher than both V=P (\(X = .10\)) and HP-LV (\(X = .10\)). The difference between HV-LP and V=P was significant at the .001 level (\(t = 3.58, df = 76\)). The difference between HV-LP and HP-LV was significant at the .01 level (\(t = 3.22, df = 44\)). Therefore corollary D of the null hypothesis was rejected.
In corollary E of Hypothesis II it was predicted that the mean of HV-LP on the Auditory-Vocal Sequencing subtest of the ITPA would not be significantly higher than that of HP-LV. As shown in Table IX, the F value of 1.64 did not reach significance at the .05 level. HV-LP, V=P, and HP-LV, with mean scores of -.01, -.40, and .08, respectively, did not differ significantly. Therefore corollary E of the null hypothesis was not rejected.

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>d.f.</th>
<th>Variance Estimate</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>5.26</td>
<td>2</td>
<td>2.63</td>
<td>1.64*</td>
</tr>
<tr>
<td>Within</td>
<td>168.15</td>
<td>105</td>
<td>1.60</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>173.41</td>
<td>107</td>
<td>. . .</td>
<td>. .</td>
</tr>
</tbody>
</table>

*Not significant at .05 level.

It was predicted in corollary F of Hypothesis II that the mean of HP-LV on the Motor Encoding subtest of the ITPA would not be significantly higher than that of HV-LP. Inspection of Table X reveals an F of only .64, which falls short of significance at the .05 level. Corollary F of the null hypothesis was not rejected. The data did not indicate that the mean scores of HV-LP, V=P, and HP-LV, which were
.68, .42, and .35, respectively, differed significantly from each other on the Motor Encoding subtest.

TABLE X
ANALYSIS OF VARIANCE OF MEAN DIFFERENCE IN MOTOR ENCODING SUBTEST SCORES FOR THREE GROUPS

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>d.f.</th>
<th>Variance Estimate</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>1.18</td>
<td>2</td>
<td>.59</td>
<td>64*</td>
</tr>
<tr>
<td>Within</td>
<td>96.69</td>
<td>105</td>
<td>.92</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>97.87</td>
<td>107</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Not significant at .05 level.

The prediction was made in corollary G of Hypothesis II that the mean of HP-LV on the Visual Motor Association subtest of the ITPA would not be significantly higher than that of HV-LP. The computed F value of 5.21, as seen in Table XI, was significant at the .01 level.

Because the computed F value met the required level of confidence, Fisher t tests were made to determine the direction and magnitude of difference between the three groups. It was found that HV-LP ($\bar{X} = .53$) scored significantly higher than V=P ($\bar{X} = -.23$) at the .01 level ($t = 3.10$, df = 76).

HP-LV ($\bar{X} = .09$) was found to have scored significantly higher than V=P at the .05 level ($t = 1.66$, df = 90). The difference between HP-LV and HV-LP did not reach significance at the required .05 level, nor was the difference in the
direction expected. Therefore corollary G of Hypothesis II was not rejected.

It was hypothesized in corollary H of Hypothesis II that the mean of HP-LV on the Visual Decoding subtest of the ITPA would not be significantly higher than that of HV-LP. Inspection of Table XII reveals an F value of 3.36, a value which is significant at the .05 level of significance.

Since the analysis of variance procedure indicated a significant difference in the mean scores of the three discrepancy groups, Fisher t tests were made to see which groups differed significantly from the others. The results of these tests indicated that the scores of V=P (\(\bar{X} = .33\)) were significantly lower than the scores of both HP-LV (\(\bar{X} = .82\)) and HV-LP (\(\bar{X} = .85\)). The difference between V=P and HP-LV was significant at the .05 level (\(t = 1.73, df = 76\)), as was the difference between V=P and HV-LP (\(t = 2.31, df = 90\)).
### TABLE XII

**ANALYSIS OF VARIANCE OF MEAN DIFFERENCE IN VISUAL DECODING SUBTEST SCORES FOR THREE GROUPS**

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>d.f.</th>
<th>Variance Estimate</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>6.86</td>
<td>2</td>
<td>3.43</td>
<td>3.36*</td>
</tr>
<tr>
<td>Within</td>
<td>107.31</td>
<td>105</td>
<td>1.02</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>114.17</td>
<td>107*</td>
<td>※※</td>
<td>※※</td>
</tr>
</tbody>
</table>

*Significant at .05 level.

The difference between HP-LV and HV-LP was not significant, and so corollary H of the null hypothesis was not rejected.

In corollary I of Hypothesis II it was predicted that the mean of HP-LV on the Visual-Motor Sequencing subtest of the ITPA would not be significantly higher than that of HV-LP. The computed F value of .36 (shown in Table XIII) was far below that required to reach significance at the .05 level. Corollary I of the null hypothesis was not rejected.

The data indicated no significant differences in the mean scores of HV-LP, V=P, and HP-LV, which were -0.87, -0.76, and -0.62, respectively, on the Visual-Motor Sequencing subtest.

### Discussion of Results

The purpose of this chapter is to present and analyze the statistical findings of this study. The data resulting from the statistical procedures of computing Pearson
TABLE XIII
ANALYSIS OF VARIANCE OF MEAN DIFFERENCE IN VISUAL-MOTOR SEQUENCING SUBTEST SCORES FOR THREE GROUPS

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>d.f.</th>
<th>Variance Estimate</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>.75</td>
<td>2</td>
<td>.37</td>
<td>.36*</td>
</tr>
<tr>
<td>Within</td>
<td>109.16</td>
<td>105</td>
<td>1.04</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>109.91</td>
<td>107</td>
<td>. . .</td>
<td>. .</td>
</tr>
</tbody>
</table>

*Not significant at .05 level.

The relationship between subtests of the WISC and the ITPA

Hypothesis I, which predicted that there would be no significant relationship between scores on subtests of the WISC and scores on subtests of the ITPA, was rejected. Two procedures were utilized to test the tenability of this hypothesis; they are (1) Pearson product-moment correlation, and (2) factor analysis of the intercorrelations of the subtests. The correlation coefficients obtained in the present
study indicate a moderate degree of relationship between the subtests of the WISC and the ITPA. This relationship is described as "moderate" because, although seventy-three of the 108 correlation coefficients were significantly different from zero, they failed to meet the test-retest reliabilities criterion (discussed below) in all but seven cases. This finding of a moderate correlation is in agreement with the results of Leton (10) and Grief (6), who both found that interrelationships between specific abilities measured on the ITPA and intelligence do exist.

Unlike the results reported by Keene (9), the results of the present study do not indicate that the overlap of the two tests is limited almost exclusively to the WISC Performance Scale. Rather, the significant correlation coefficients obtained indicate that the overlap of the tests exists in both Verbal and Performance Scales. Indeed, the data of the present study indicate a somewhat greater degree of overlap with the Verbal Scale.

Inspection of the intercorrelations of the subtests and the factor loadings yields little evidence that any one subtest of the ITPA is interchangeable with any one or any few specific WISC subtests. Instead, the correlation coefficients are of about the same magnitude with each ITPA subtest, indicating a relationship between the specific abilities tapped by the ITPA and a general intelligence factor rather than a relationship between these specific abilities and the
different abilities measured by each WISC subtest. There are three possible exceptions. One is the moderately high (.80) correlation between the Auditory-Vocal Automatic subtest and the Mazes subtest. Using as criterion the test-retest reliabilities of the ITPA subtests, as reported in McCarthy and Kirk (11), these two subtests are interchangeable because the correlation coefficient falls between the test-retest reliability coefficients of the Auditory-Vocal Automatic subtest. Both subtests appear to measure the ability to plan and to predict future events. Table XIV shows the reliability coefficients reported by the authors of the ITPA. McCarthy and Kirk furnish two reliability coefficients for each subtest and age level. The standardization sample was restricted by eliminating any subject who scored more than ± one standard deviation on the Stanford-Binet. Test-retest reliability coefficients were lowered using this restricted range. The authors extrapolated from these data to report a reliability coefficient for an unrestricted range of intelligence (12, p. 31; 11, p. 108).

A second exception, using the test-retest reliabilities criterion, is the correlation of the Visual-Motor Association subtest with the Information (correlation coefficient of .41), Arithmetic (.34), Similarities (.35), Object Assembly (.39) and Mazes (.68) subtests. Each of these correlation coefficients meets the test-retest reliabilities criterion. Therefore, if a subject responds near age level (i.e. -1
TABLE XIV
TEST-RETEST COEFFICIENTS OF ITPA*

3-mo. Interval
N=69, Age 6-6.6

<table>
<thead>
<tr>
<th>Subtest</th>
<th>1**</th>
<th>2***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory-Vocal Automatic</td>
<td>.92</td>
<td>.72</td>
</tr>
<tr>
<td>Visual Decoding</td>
<td>.80</td>
<td>.45</td>
</tr>
<tr>
<td>Motor Encoding</td>
<td>.73</td>
<td>.49</td>
</tr>
<tr>
<td>Auditory-Vocal Association</td>
<td>.96</td>
<td>.79</td>
</tr>
<tr>
<td>Vocal Encoding</td>
<td>.73</td>
<td>.37</td>
</tr>
<tr>
<td>Auditory-Vocal Sequencing</td>
<td>.95</td>
<td>.86</td>
</tr>
<tr>
<td>Visual Motor Association</td>
<td>.74</td>
<td>.34</td>
</tr>
<tr>
<td>Auditory Decoding</td>
<td>.87</td>
<td>.50</td>
</tr>
</tbody>
</table>

*Taken from McCarthy and Kirk (11, p. 31).
**Corrected for restricted range.
***Restricted range

standard deviation or better) on the five WISC subtests listed, administration of the Visual-Motor Association subtest is unnecessary.

The third possible exception is the correlation of the Vocal Encoding subtest with the Vocabulary subtest. The correlation coefficient of .37, while not high, does fall between the given test-retest reliability coefficients, and so meets the criterion for interchangeability. Both the Vocal Encoding and Vocabulary subtests appear to be measures of verbal expression. If the subject responds near age level on the Vocabulary subtest and the Information subtest (which shows a correlation coefficient of .36), it may be that administration of the Vocal Encoding subtest is unnecessary. Caution should be excercised, however, in drawing conclusions about the interchangeability of specific WISC and ITPA subtests.
subtests. Except for the moderately high correlation between the Auditory-Vocal Automatic and the Mazes subtests, the consistently low to moderate correlation coefficients appear to point to a relationship between the specific abilities measured by the ITPA and a general intelligence factor rather than a relationship between the specific abilities measured by the ITPA subtests and the specific abilities measured by the individual subtests of the WISC.

The results of the factor analysis of the intercorrelations also lend support to the conclusion that the relationship between the ITPA and the WISC is primarily one of relationship of the abilities measured by the ITPA to a general intelligence factor. Factor I, which accounts for more than thirty-six per cent of the variance, has primary and secondary loadings from four of the ten WISC subtests and four of the nine ITPA subtests. Like the correlation coefficients just discussed, the magnitude of these loadings is neither extremely high nor extremely low, but rather is consistently moderate. The nature of Factor I predominantly involves visual organizing abilities and the comprehension of visual symbols, general abilities which draw from several more specific abilities, such as the ability to anticipate and plan, the ability to recognize essential details, and the ability to understand the spoken word.

The other three factors extracted, together accounting for about twenty-two per cent of the variance, indicate
little overlap in the traits measured by the two tests. Factors II and IV are heavily loaded by WISC variables and Factor III is dominated by ITPA variables. The uniqueness of these factors to the separate tests, while not justifying the conclusion that the tests are not related, does, like the low to moderate correlation coefficients, emphasize the limited and rather obscure degree of relationship between the WISC and the ITPA.

The contradictions among the previous studies exploring the relationship between the WISC and the ITPA, as discussed in Chapter II, was one of the reasons motivating the present study. The varying results of the studies of Garms (5), Leton (10), Keene (9) and Cohen (3) have already been mentioned. An attempt will now be made to find the commonalities of these studies and the present study, establishing just what is the closest estimate of the nature of the factors of the two tests. First, the area of greatest disagreement appears to be the nature of the first factor in each study, including the present study. This factor accounts for the greatest per cent of the variance and is loaded by both WISC and ITPA variables. Its obscure nature again emphasizes the loose, general way in which the tests are related. Factor I in the present study has been termed Verbal Organization and Comprehension of Symbols and is somewhere between Garms' (5) Verbal Organizational and Integrative Ability factor, an even more obscure general factor,
and Leton's (10) Verbal Association factor, a more specific factor. Factor II in the present study, termed Visual Analysis, is similar to Keene's (9) and Cohen's (3) Perceptual Organization factor. It is predominantly a WISC performance factor. Factor III, a Memory and General Linguistic factor, is like Keene's (9) Auditory-Visual Memory factor. Factor III is heavily loaded by ITPA variables. Factor IV, Verbal-Symbolic Retention, is similar to Cohen's (3) Verbal Comprehension I and Leton's (10) Verbal-Educative factor. This factor is loaded appreciably by WISC Verbal subtests. The results of the present study, then, serve as a clarification and means of compromise of four studies reporting various numbers and kinds of factors. The present study confirms that the WISC and the ITPA do tap a common, though general and obscure, factor. This study, like the others reported, also indicates that the two tests tap separate, more specific abilities. The results of the present study therefore confirm Leton's (10) statement that the subtests of the WISC and the ITPA measure somewhat the same dimensions of ability and intellectual processes and that their joint use is justified. The results of the present study call for the exercise of caution, however, in following Garms' (5) tentative suggestion that it is necessary only to administer the WISC in order to get a measure of a child's performance on both the WISC and the ITPA.
The Relationship of WISC Verbal-Performance
Discrepancies to the ITPA Subtests

In Hypothesis II, which was stated in the null form, it was predicted that there would be no significant relationship between scores on subtests of the WISC and scores on subtests of the ITPA. Hypothesis II had nine corollary hypotheses, also stated in the null form. Each of these corollaries dealt with how HV-LP could be expected to score in relationship to HP-LV on each of the nine subtests of the ITPA. An analysis of variance procedure was used to test the tenability of each of the nine corollaries. Two of the null hypotheses were rejected at the .01 level; the remaining seven corollaries were not rejected. A summary of the results of the analyses of variance and the individual group comparisons for each of the nine ITPA subtests, as well as for the WISC Verbal, Performance and Full Scale scores and the ITPA total language score, is presented in Table XV. Table XV also shows the scale score means and standard deviations for the three discrepancy groups on all of the ITPA subtest scores, on age, and on the WISC Verbal, Performance and Full Scale scores.

Examination of Table XV reveals that HV-LP and HP-LV, the two main groups of interest, do not differ significantly either in the age of the subjects or Full Scale IQ. Therefore it is likely that the differences that do exist in their ITPA subtest scores represent real differences between
TABLE XV
MEANS AND STANDARD DEVIATIONS FOR AGE, WISC VIQ, PIQ, FSIQ, AND FOR SCORES ON ITPA SUBTESTS AND TOTAL LANGUAGE, AND p LEVELS FOR THE ANALYSIS OF VARIANCE AND THE COMPARISONS AMONG THE THREE GROUPS

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group Comparisons</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=16</td>
<td>N=62</td>
<td>N=30</td>
<td>3 &amp; 12 &amp; 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 &amp; 2</td>
</tr>
<tr>
<td>Age Months</td>
<td>M 121.00</td>
<td>119.63</td>
<td>121.57</td>
<td>p</td>
</tr>
<tr>
<td>VIQ</td>
<td>M 120.44</td>
<td>94.92</td>
<td>93.10</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>SD 13.74</td>
<td>21.80</td>
<td>13.00</td>
<td>0.001</td>
</tr>
<tr>
<td>PIQ</td>
<td>M 99.50</td>
<td>94.34</td>
<td>114.23</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>SD 16.13</td>
<td>21.59</td>
<td>12.36</td>
<td>0.001</td>
</tr>
<tr>
<td>FSIQ</td>
<td>M 111.56</td>
<td>94.66</td>
<td>103.40</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>SD 15.67</td>
<td>22.05</td>
<td>13.79</td>
<td>0.01</td>
</tr>
<tr>
<td>ITPA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Language</td>
<td>M 74.06</td>
<td>71.83</td>
<td>62.63</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD 52.43</td>
<td>51.84</td>
<td>50.00</td>
<td></td>
</tr>
<tr>
<td>Auditory Decoding</td>
<td>M 1.11</td>
<td>.55</td>
<td>.69</td>
<td>.10</td>
</tr>
<tr>
<td></td>
<td>SD .87</td>
<td>.95</td>
<td>.84</td>
<td>0.05</td>
</tr>
<tr>
<td>Visual Decoding</td>
<td>M .82</td>
<td>.33</td>
<td>.85</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td>SD 1.16</td>
<td>.92</td>
<td>1.11</td>
<td></td>
</tr>
<tr>
<td>Aud. Voc. Association</td>
<td>M .92</td>
<td>.23</td>
<td>-0.01</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td>SD .73</td>
<td>1.17</td>
<td>1.16</td>
<td></td>
</tr>
<tr>
<td>Vis.-Mot. Association</td>
<td>M .53</td>
<td>-.23</td>
<td>.09</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>SD .94</td>
<td>.86</td>
<td>.86</td>
<td></td>
</tr>
<tr>
<td>Vocal Encoding</td>
<td>M 1.15</td>
<td>.45</td>
<td>.36</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD 1.04</td>
<td>1.41</td>
<td>1.45</td>
<td></td>
</tr>
<tr>
<td>Motor Encoding</td>
<td>M .68</td>
<td>.42</td>
<td>.35</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD 1.00</td>
<td>.93</td>
<td>.99</td>
<td></td>
</tr>
<tr>
<td>Aud.-Voc. Automatic</td>
<td>M 1.19</td>
<td>.10</td>
<td>.10</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>SD .57</td>
<td>1.17</td>
<td>1.10</td>
<td></td>
</tr>
<tr>
<td>Aud.-Voc. Sequencing</td>
<td>M -.01</td>
<td>-.40</td>
<td>.08</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD .83</td>
<td>1.38</td>
<td>1.20</td>
<td></td>
</tr>
<tr>
<td>Vis.-Mot. Sequencing</td>
<td>M -.87</td>
<td>-.76</td>
<td>-.62</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD 1.01</td>
<td>1.00</td>
<td>1.08</td>
<td></td>
</tr>
</tbody>
</table>
the groups. As was previously pointed out, HV-LP and HP-LV both differ significantly in Full Scale IQ from V-P. The three groups do not differ significantly in mean age.

The discussion of the results of the analyses of variance of the nine corollaries will be divided into two groups: (1) the first five corollaries, which deal with the subtests in the Auditory-Vocal Channel of the ITPA, measuring verbal, language, and auditory perceptual skills; and (2) the latter four corollaries, which deal with the subtests in the Visual-Motor Channel of the ITPA, measuring visual-perceptual skills. Of the five subtests in the Auditory-Vocal Channel, two were found, as expected, to be significantly related to the direction of WISC Verbal-Performance discrepancy. A third subtest, while not reaching significance at the .05 level, showed a definite trend towards being related to the direction of WISC Verbal-Performance discrepancy. The remaining two subtests showed the same expected trend to a lesser extent. Therefore the performance of the discrepancy groups on all five subtests in the Auditory-Vocal Channel of the ITPA was more or less as predicted from Rourke, Young and Flewelling (15) and Polley's (14) results. It will be recalled that Polley's (14) results indicated that the Auditory-Vocal Channel correlated significantly higher with the WISC Verbal Scale than with the WISC Performance Scale. It will also be remembered that Rourke, Young and Flewelling (15) found that those subjects who did better on the Verbal Scale than on the
Performance Scale could be expected to do better on tasks that involve verbal, language and auditory-perceptual skills than those whose Performance Scale IQ was ten points or more higher than their Verbal Scale IQ.

The results of the comparisons of the discrepancy groups on the five subtests in the Auditory-Vocal Channel of the ITPA (Auditory-Vocal Association, Auditory Decoding, Vocal Encoding, Auditory-Vocal Automatic, and Auditory-Vocal Sequencing) support the contention that WISC Verbal-Performance discrepancies can be used to predict rather consistent differential performances on the subtests of the ITPA which tap verbal, language and auditory-perceptual skills. These predictions can be made with especial certainty in the cases of the Auditory-Vocal Association and the Auditory-Vocal Automatic subtests, on which HV-LP scored significantly higher at the .01 level than HP-LV. It is possible that the differences between the two groups were more clear-cut on these latter two subtests because of their greater reliability (as shown in test-retest reliability coefficients seen in Table XIV) and the fact that they correlate higher with the Auditory-Vocal Channel than the other subtests and have been found to have the greatest prognostic utility as far as achievement is concerned (7). Other indications of why the Auditory-Vocal Association subtest was found in the present study to be one of the most useful subtests in differentiating discrepancy groups are Mueller's (13) finding that the
overall validity of the ITPA is accounted for primarily by the Auditory-Vocal Association subtest and Cicirelli's (2) finding that the Auditory-Vocal Association subtest is one of the best predictors of achievement as measured by the Metropolitan Readiness Test and the Stanford Achievement Test. Similarly, Ikeda (8) found that the Auditory-Vocal Association subtest correlated higher than other subtests with reading ability, and Bonfield (1) found that the Auditory-Vocal Association and Auditory-Vocal Automatic subtests were better predictors of the overall achievement of institutionalized educable mentally retarded children. Also contributing to the significant differences found between the groups on the ITPA subtests measuring verbal, language and auditory-perceptual skills is the fact that the Verbal Scale of the WISC has been shown (16) to be more stable and reliable than the Performance Scale.

The results of the comparisons of HV-LP and HP-LV on the four subtests in the Visual-Motor Channel of the ITPA (Motor Encoding, Visual-Motor Association, Visual Decoding, and Visual-Motor Sequencing) did not meet the required .05 level of significance in any case. On two of the four subtests, Visual Decoding and Visual-Motor Sequencing, the differences between the discrepancy groups were in the expected direction, but these differences were not of sufficient magnitude to reach significance at the .05 level. On the Visual-Motor Association and Motor Encoding subtests
the differences were in the opposite direction from that expected, with HV-LP scoring somewhat higher (though not significantly so) than HP-LV. In the case of these four sub-tests, particularly the latter two, it appears that such verbal organizational skills as the ability to evaluate past experiences and visual memory ability are more related to high scores than are the nonverbal organizational and motor skills which would be expected. This would explain why High Verbal scorers, who would possess the former skills to a greater degree, would score as well as or higher on these subtests than would High Performance scorers.

Just as the reliability and validity of the respective subtests were helpful in shedding light on the relationship between the discrepancy groups and the subtests in the Auditory-Vocal Channel, the reliability and validity of the subtests in the Visual-Motor Channel can be used to explain the failure of the comparisons to reach significance. Not only are the test-retest reliability coefficients of these subtests lower (as shown in Table XIV), but the results of Hirshoren (7) indicated that they have comparatively less prognostic utility, and Egeland (4) found that the Visual Decoding and Motor Encoding subtests, along with the Vocal Encoding subtest, were the only ITPA subtests which did not correlate with his achievement criteria. These criteria consisted of scores on the Word Knowledge, Word Discrimination, Reading and Arithmetic tests of the Metropolitan
Achievement Test, Primary I Battery, Form A. It appears that the subtests in the Visual-Motor Channel possess the same shortcomings of other measures of visual-perceptual skills, including the WISC Performance Scale (16); the data indicate that they are less reliable and valid than are tests of verbal and language ability.

The results of the present study are in agreement with Polley's (14) finding that the correlations between the Visual-Motor Channel of the ITPA and the Verbal and Performance Scales of the WISC were not significantly different. Contrary to what was expected from Rourke, Young and Flewelling's (15) finding that WISC Verbal-Performance discrepancy scores are related to visual-perceptual skills, the results of the present study do not indicate a relationship between discrepancy scores and motor skills, at least as measured by the subtests in the Visual-Motor Channel of the ITPA. It is probable that the difference in the findings of the present study and that of Rourke, Young and Flewelling is due to the nature of the measures of visual-motor skills. Rourke, Young and Flewelling used the Trail Making Test and the Target Test, both of which are relatively straightforward tests of spatial visualization and spatial orientation. The subtests in the Visual-Motor Channel of the ITPA, as has been mentioned, appear to require the additional skills of being able to evaluate past experiences, make visual comparisons, and utilize visual memory. The results of the comparisons
of the discrepancy groups on the Visual-Motor Channel sub-
tests, then, fail to support the contention that WISC Verbal-
Performance discrepancies can be used to predict consistent
differential performance on the subtests of the ITPA which
involve visual-perceptual abilities.

The results of the comparisons of a third discrepancy

group, V=P, with the other discrepancy groups on each of
the ITPA subtests are also shown in Table XV. Though the
primary groups of interest were HV-LP and HP-LV, V=P was
included as a representation of the more normal or usual
WISC score. It was expected that the scores of this group
would occupy an intermediate position between the scores of
the two more extreme groups. With a few exceptions, this
expectation was confirmed by the data of the present study.

Summary

Statistical results presented in Chapter IV have indi-
cated that there is a significant relationship between scores
on subtests of the WISC and scores on subtests of the ITPA.
Therefore Hypothesis I was rejected. The data also indicated
that there is a significant difference in the means of the
Auditory-Vocal Association and Auditory-Vocal Automatic sub-
test scores of the WISC HV-LP and HP-LV groups. Therefore
two of the nine corollaries of Hypothesis II were rejected.
The statistical findings were presented and the results of
the statistical procedures followed were discussed. Possible
explanations of the significance or non-significance of the data, utilizing relevant previous research, were offered.
CHAPTER BIBLIOGRAPHY


CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This study was undertaken to investigate (1) the relationship between the subtests of the Wechsler Intelligence Scale for Children (WISC) and the Illinois Test of Psycholinguistic Abilities (ITPA), and (2) the relationship between WISC Verbal-Performance discrepancy scores and the subtests of the ITPA. The results obtained indicated a moderate degree of relationship between WISC and ITPA subtests and a significant relationship between the Auditory-Vocal Association and Auditory-Vocal Automatic subtests of the ITPA and WISC Verbal-Performance discrepancies.

The limitations of the present study were recognized, and relevant terms were defined. The assumptions pertaining to the study were discussed.

The subjects used in this study were the 132 children who were referred to the Pupil Appraisal Center, North Texas State University, Denton, Texas, during the academic years 1967-1973, who were administered both the ITPA and the WISC. The children were referred by their schools because of lack of school achievement. They ranged in age from six years...
two months to fifteen years four months. All of the subjects lived in and attended public schools in Denton County or neighboring counties.

The Wechsler Intelligence Scale for Children and the Illinois Test of Psycholinguistic Abilities were the instruments used in this study. Test scores of the 132 subjects were obtained following a careful review of the records of the total population referred to the Pupil Appraisal Center during its first five years (1967-1973) of operation. These data were coded and punched on IBM cards. Statistical analyses were computed on the IBM 360/50 computer at the Data Processing Center, North Texas State University, Denton, Texas.

Two main hypotheses were investigated in an effort to gain information relative to the degree of relationship between the subtests of the WISC and the ITPA and the relationship between WISC Verbal-Performance discrepancies and ITPA subtests. Hypothesis II consisted of nine corollaries.

The .05 level of significance was established as the basis upon which the null hypotheses would be rejected. The tenability of Hypothesis I was tested through the use of intercorrelation and factor analysis procedures. The statistical method used for testing Hypothesis II was analysis of variance.

In Hypothesis I it was predicted that there would be no significant relationship between mean scores on subtests
of the WISC and mean scores on subtests of the ITPA. A number of the correlation coefficients computed to test this hypothesis reached the level of significance established. Also, factor analysis of the intercorrelation of the subtests indicated a moderate degree of overlap in the subtests of the WISC and the ITPA. Therefore the null hypothesis was rejected. It was concluded that a moderate relationship exists between the subtests of the WISC and the subtests of the ITPA.

The prediction was made in Hypothesis II that there would be no significant difference in the means of the ITPA subtest scores of the WISC High Verbal-Low Performance group (HV-LP) and the WISC High Performance-Low Verbal group (HP-LV). In the nine corollaries of Hypothesis II, predictions were made about the performance of HV-LP in relationship to HP-LV on each of the nine subtests of the ITPA. Corollary A predicted that the mean of HV-LP on the Auditory-Vocal Association subtest of the ITPA would not be significantly higher than HP-LV. The analysis of variance procedure resulted in an F value significant at the .05 level, and individual comparisons of HV-LP and HP-LV were significant at the .01 level. Therefore corollary A of the null hypothesis was rejected. Those with High Verbal scores scored significantly higher than those with High Performance scores on the Auditory-Vocal Association subtest.
In corollaries B and C of Hypothesis II it was predicted that the mean of HV-LP on the Auditory Decoding and Vocal Encoding subtests, respectively, would not be significantly higher than that of HP-LV. There were no significant differences in mean subtest scores for these two discrepancy groups on either of these variables.

The prediction was made in corollary D that the mean of HV-LP on the Auditory-Vocal Automatic subtest of the ITPA would not be significantly higher than that of HP-LV. The F value was significant at the .001 level, and individual comparisons indicated that the difference between HV-LP and HP-LV was significant at the .01 level. Therefore corollary D of the null hypothesis was rejected. High Verbal scorers scored significantly higher than High Performance scorers on the Auditory-Vocal Automatic subtest.

It was predicted in corollary E that the mean of HV-LP on the Auditory-Vocal Sequencing subtest would not be significantly higher than that of HP-LV. In corollaries F, G, H, and I it was predicted that the mean of HP-LV on the Motor Encoding, Visual-Motor Association, Visual Decoding, and Visual-Motor Sequencing subtests, respectively, would not be significantly higher than that of HV-LP. Data analysis revealed no significant differences between the scores of HV-LP and HP-LV on any of these variables.

As a whole, the results of the study were interpreted as justifying the rejection of null Hypothesis I and two of
the nine corollaries of Hypothesis II. Several possible reasons for the significance or non-significance of the results were offered.

Findings

The following findings emerged on the basis of this study:

1. There is a moderate degree of relationship between the subtests of the WISC and the subtests of the ITPA.

2. Subjects whose Verbal Scale IQ was at least fifteen points higher than their Performance Scale IQ (HV-LP) scored significantly higher on the Auditory-Vocal Association and Auditory-Vocal Automatic subtests of the ITPA than did subjects whose Performance Scale IQ was at least fifteen points higher than their Verbal Scale IQ (HP-LV); therefore there is a significant relationship between WISC Verbal-Performance discrepancy scores and these two subtests of the ITPA.

3. There were no significant differences in scores on the Auditory Decoding, Vocal Encoding, Motor Encoding, Visual Motor Association, Visual Decoding, and Visual-Motor Sequencing subtests of the ITPA between HV-LP and HP-LV; therefore no significant relationship between Verbal-Performance discrepancy scores and these subtests of the ITPA was indicated.

Conclusions

On the basis of the findings of the present study, several conclusions seem warranted. These are:
1. There is a moderate degree of overlap in the traits measured by the WISC and the ITPA.

2. The overlap of traits tapped by the WISC and the ITPA is present to a somewhat greater degree in the measures of verbal, language and auditory perceptual skills than in the measures of visual-perceptual skills; that is, there is a greater overlap between the subtests of the WISC Verbal Scale and the subtests of the Auditory-Vocal Channel of the ITPA than between the subtests of the WISC Performance Scale and the subtests of the Visual-Motor Channel of the ITPA.

3. The ITPA Auditory-Vocal Automatic subtest and the WISC Mazes subtest are interchangeable; a high score on one would mean a high score on the other, and one can be given in lieu of the other.

4. Other than the Mazes and Auditory-Vocal Automatic subtests, no WISC and ITPA subtests are interchangeable; that is, no one WISC subtest can be given in lieu of any one ITPA subtest.

5. If a subject responds near age level on the WISC Arithmetic, Similarities, Object Assembly, and Mazes subtests, administration of the ITPA Visual-Motor Association subtest is unnecessary.

6. WISC Verbal-Performance discrepancies can be used to predict rather consistent differential performances on the subtests of the ITPA which tap verbal, language and auditory perceptual skills, that is, those subtests in the
Auditory-Vocal Channel, especially the Auditory-Vocal Association and Auditory-Vocal Automatic subtests.

7. WISC Verbal-Performance discrepancies cannot be used to predict consistent differential performances on the subtests of the ITPA which purport to measure visual-perceptual skills, that is, those subtests in the Visual-Motor Channel.

8. The four subtests in the Visual-Motor Channel of the ITPA, particularly the Visual-Motor Association and Motor Encoding subtests, appear to be measures of verbal organizational skills rather than the nonverbal organizational and motor skills for which they were designed.

Recommendations

In view of the findings of this study, the following recommendations are made:

For Future Research

1. Scores from both the Experimental and Revised versions of the ITPA should be obtained in the case of a replication of the present study so that a check on the comparability of the two forms may be made.

2. In order to get a truer measure of the differences between the three discrepancy groups (HV-LP, V=P, HP-LV), these three groups should be matched by age and Full Scale IQ.

3. Replication of the present study using a normal population is recommended in order to indicate whether the
differences in the scores of learning-disabled subjects on the WISC and the ITPA are also present in the scores of normal subjects.

4. Research should be designed so that the WISC could be used to suggest specific remediation such as that suggested by the ITPA. A possible means to this end would be to administer both the WISC and ITPA, apply remediation as suggested by the ITPA, re-administer both tests, and compare the changes in scores on both measures.

5. Further checks of the prognostic utility of both the WISC and the ITPA are needed. Pre and post scores of both tests should be compared with such measures as grade point average, reading level, and achievement level.

For Psychoeducational Appraisal

1. It is recommended that the WISC be given in its entirety in order to obtain a measure of the subject's general intellectual functioning. If the subject fails to respond near age level on a majority of the subtests, then the ITPA should be administered in order to provide support for the WISC data and to pinpoint specific assets and disabilities.

2. If it is possible only to administer either the WISC or the ITPA, it is recommended that the WISC be selected because of its higher degree of stability and reliability.
### APPENDIX A

**SUMMARY STATISTICS FOR WISC SUBTEST, VIQ, PIQ, AND FSIQ SCORES**

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<thead>
<tr>
<th>Test</th>
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APPENDIX B

SUMMARY STATISTICS FOR ITPA SUBTEST
AND TOTAL LANGUAGE SCORES

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<td>Total Language Age</td>
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APPENDIX C

VARIABLE LOADINGS BEFORE VARIMAX ROTATION

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