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A COMPARISON OF THE ASSOCIATIVE LEARNING RATES OF STUDENTS HAVING A SIGNIFICANT VERBAL-PERFORMANCE IQ DISCREPANCY ON THE WECHSLER INTELLIGENCE SCALE FOR CHILDREN

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APPROVED BY

Robert Ragland

Loy E Prickett

Bernard Field

DISSERTATION COMMITTEE

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CHAPTER I

INTRODUCTION AND STATEMENT OF THE PROBLEM

Diagnosis of children with learning disabilities frequently includes looking for a significant discrepancy between Verbal IQ and Performance IQ scores on the Wechsler Intelligence Scale for Children (WISC) when the Full Scale IQ is within the average range of 90-110. Although additional tools are frequently used in the diagnostic process, a great deal of consideration is given to a child's functioning on the WISC, particularly if the Verbal IQ/Performance IQ has a fifteen-point, or greater, spread.

The diagnostic process used to examine children who have been identified as having possible learning disabilities of a specific nature needs to be examined more closely. Placement of diagnosed children usually includes (1) fulltime or parttime placement in classes for children with learning disabilities, (2) assignment to resource rooms or learning labs, or (3) preparation of prescriptive regular classroom. These placement alternatives need to be based upon objective evaluation procedures.

All possible areas of learning should be investigated during the evaluation of the student so that the

student's complete learning potential can be referenced in recommending placement and preparing individualized learning plans. Consequently, this research studies one area of learning, associative learning, and how it relates to verbal IQ and Performance IQ.

Associative learning has been of growing interest, especially since the mid-1950's; however, results of investigations in the area of associative learning have not always been compatible. Eisman (1958) reported his study of differences in learning, generalization, and retention between retarded, average, and superior groups of children. Paired-associates techniques were used in his study. No significant differences in performance were revealed among the three groups.

Ring and Palermo's (1961) later, similar study resulted in findings contradictory to those of Eisman. They found that normal individuals performed significantly better than retarded subjects of the same chronological age. No significant difference in the learning rate among retarded, normal, and bright children was found, however, by Hiner (1962) in her study using a paired-associates learning task.

While many studies in paired-associates learning compared groups designated as normal, bright, or retarded, there was research conducted comparing differing ethnic groups (Purdy, 1968) and differing ethnic and socio-economic

groups (Prickett, 1970). No significant differences in the learning rates of paired-associates material were reported in the final analyses of these studies

The present study is different from earlier studies of associative learning rates because it investigates students grouped by types of "mental operation," and further grouped into female and male categories.

Statement of the Problem

The problem investigated in this research effort was as follows: Do the associative learning rates of children with normal IQ scores differ from the associative learning rates of children having a significant discrepancy between their verbal and performance IQ scores? More precisely, Do the associative learning rates of eight-, nine-, and ten-years old students with normal IQ scores differ from the associative learning rates of students having either high-verbal/low-performance IQ scores or low-verbal/high-performance IQ scores? Comparisons were also made between male and female students' associative learning rates at all three categories of mental functioning.

Hypotheses Tested in the Study

In order to achieve the stated purpose of the study, six (6) hypotheses were tested for significance at the .05 level. These six null hypotheses were stated as follows:

Ho_1 There is no statistically significant difference between the Trials-to-Criterion scores of the females and the Trials-to-Criterion scores of the males.

Ho_2 There are no statistically significant differences among the Trials-to-Criterion scores of the High Verbal, High Performance, and No-Difference student groups.

Ho_3 There is no statistically significant interaction between the two independent variables of Sex and Student Group as reflected in the Trials-to-Criterion scores of the six subgroups.

Ho_4 There is no statistically significant difference between the Errors-to-Criterion scores of the females and the Errors-to-Criterion scores of the males.

Ho_5 There are no statistically significant differences among the Errors-to-Criterion scores of the High Verbal, High Performance, and No-Difference student groups.

Ho_6 There is no statistically significant interaction between the two independent variables of Sex and Student Group as reflected in the Errors-to-Criterion scores of the six subgroups.

The hypotheses were tested for significance by using a two-way analysis of variance (ANOVA) testing statistic. This statistical technique yields three F values-one for the main effect of Sex, one for the main effect of Student Group, and one for the interaction effects of the two variables. Significant F values were followed by studentized range statistics in an attempt to locate specific differences among the various group means. The Newman-Keuls Test was the range test chosen

for the present study. Further explanations of these statistical procedures are presented in the methodology of Chapter III.

Definition of Terms

It was necessary to define several terms which were used in the present study. The definitions presented in this section are given only as the terms were used in the study and are not intended to be universal definitions.

1. Learning: Change in behavior brought about by reinforced practice.
2. Associative Learning: The spatial and temporal linking of two events.
3. Paired-Associates Material: Material used in verbal learning consisting of a list of pairs of items in which one item of the pair serves as a stimulus and the other as a response.
4. Stimulus Item: The first of two items presented to a subject in paired associates material.
5. Response Item: The second of two items presented to a subject in paired-associates material.
6. Paired-Associates Learning: Learning to respond with a second item of a pair when the

first item of paired-associates material is presented.

7. Trials-to-Criterion Score: The cumulative total of trials necessary for the student being tested to achieve two successive correct repetitions of the 16-Picture Paired-Associates Learning Task (PALT).
8. Student Error: Lack of an answer within a five-second time limit on the individual flash cards making up the paired-associate task, or an incorrect response within the five-second period.
9. Errors-to-Criterion Score: The cumulative total of all errors recorded, for the subject being tested, during the trial sequences needed to achieve two successive, correct repetitions of the 16-Picture PALT.
10. Learning Disabilities: Neuro-psychological deficits. Children with learning disabilities are defined as those children with normal or potentially normal intelligence who because of some neuro-psychological factor are noted to have learning disabilities of a perceptual, conceptual, or integrative nature.
11. Verbal IQ Score: The sum of the five verbal

scaled scores on the Wechsler Intelligence Scale for Children or WISC (Information Comprehension, Arithmetic, Similarities, and Vocabulary) converted to an IQ score.

12. Performance IQ Score: The sum of the five performance scaled scores on the WISC (Picture Completion, Picture Arrangement, Block Design, Object Assembly, and Coding) converted to an IQ score.
13. Full Scale IQ Score: The sum of the verbal score and the performance score on the WISC converted to IQ (Based on ten sub-tests).
14. Normal Intelligence: A resultant intelligence quotient (IQ) within the 90-110 range as measured by the Wechsler Intelligence Scale for Children.
15. Verbal/Performance Discrepancy: An arithmetic difference of fifteen (15) points or more between the Verbal IQ score and the Performance IQ score attained by an individual student.
16. High Verbal Group: Those students whose Verbal IQ scores were determined to be fifteen or more points higher than their Performance IQ scores on the WISC.

17. High Performance Group: Those students whose Performance IQ scores were more than fifteen (15) points higher than their Verbal IQ scores on the WISC.
18. No-Discrepancy/No-Difference Group: Those students who showed less than five (5) IQ points discrepancy between their Verbal IQ scores and Performance IQ scores on the WISC.

Assumptions Made in the Study

Several assumptions were made in the proposed study. These assumptions were primarily associated with population of students and the data collection instruments. The primary assumptions made were as follows:

1. It was assumed that associative learning is a legitimate area of study and can be measured.
2. It was assumed that the eight-, nine-, and ten-years old subjects selected randomly for this study represented an adequate cross-section of these age brackets.
3. It was assumed that the 16-Picture Paired-Associate Learning Task is a valid and reliable instrument for measuring the associative learning rates of eight-,

nine-, and ten-years old students.

4. It was assumed that the Wechsler Intelligence Scale for Children is a valid and reliable instrument for measuring Verbal IQ, Performance IQ, and Full Scale IQ.

Limitations of the Study

Certain limitations were made on the present study in order to make data collection possible. The most important limitations were as follows:

1. The participant population was limited to sixty (N=60) students eight-, nine-, and ten-years of age enrolled in elementary schools in two separate regions served by two of Oklahoma's Regional Education Service Centers during the 1975-76 academic year.
2. The study was limited to white (Anglo) children, thus controlling ethnic and cultural variables.
3. The participant population was limited to students whose Full Scale IQ on the WISC was within the 90 to 110 IQ bracket.
4. The associative learning variable was limited to the student's performance on the

16-Picture PALT.

5. When the examiner administered the 16-Picture PALT, he had access to data about which group each subject was in, although he did not refer to this data.

CHAPTER II

REVIEW OF RELATED LITERATURE

Germany's Wundt (1879) is generally credited with being the early pioneer in studying individual psychological differences as England's Galton (1883) is recognized for early contributions in statistical analysis. Binet of France, however, is the recognized originator of a practical method of measuring intelligence. Earlier attempted measures of intellect included palmistry, various head measurements, and graphology. Binet introduced into the concept of intelligence ideas such as judgment, adaptation, and self-criticism and in 1905 introduced the first scale for the measurement of intelligence.

Beginning of Measured Intelligence

Terman and Merrill (1960) state:

> . . . "One of Binet's basic assumptions of the original (Binet-Simon) scale was that a person is thought of as normal if he can do the things persons of his age normally do, retarded if his test performance corresponds to the performance of persons younger than himself, and accelerated if his performance level exceeds that of persons his own age." (p. 5).

Thus Binet is credited with establishing the concept of mental age.

Binet's concept of mental age was used by Terman

in the development of the Stanford Binet Intelligence Scale in 1916. Explaining their use of the terminology 'mental age' Terman and Merrill (1937) stated that it "refers to mental age on a particular intelligence test." It may not coincide with a subject's age score on tests of social adjustment, musical ability, and such.

Thorndike (1927) did not emphasize the mental age concept when he developed an intelligence scale, the CAVD (the symbol CAVD refers to the four series of tasks - Completions, Arithmetical Problems, Vocabulary, and Directions). The CAVD gives scores in equal linear units beginning with zero. Such a scoring system is in line with his philosophy that "Whatever exists at all exists in some amount. To know it thoroughly involves knowing its quantity as well as its quality" (Thorndike, 1918).

Wechsler (1949) advocates "complete renunciation" of the concept of mental age as a basic measure of intelligence, speaking primarily in terms of IQ scores, standard deviation, and percentile limits in discussing individual performance on the Wechsler Intelligence Scale for Children (WISC).

Learning Rate and Associative Learning

Learning rate is a factor considered in measuring the intellectual level of the individual. Wechsler includes learning rate as an intellective factor in his

tests of intelligence as does Binet (1916), Terman (1937, 1960), and other early leaders. Group tests of intelligence incorporate learning rate as a part of measurement.

Learning rate and associative learning are discussed by Hall and Lindzey (1957). They refer to associative learning as the spatial and temporal linking of two events. Associative learning is presumed to be a function of intelligence. McGeoch (1942) says learning is the improvement in performance resulting from repetitive practice in response to stimuli held constant throughout the learning period.

Learning Disabilities and Associative Learning

The term "learning disabilities" as a category of handicapping conditions came into common usage in 1963 after Kirk (1963) used it in a speech at the annual meeting of the Conference on Exploration into the Problems of the Perceptually Handicapped Child. Many of the studies and much research prior to 1963, therefore, refers to such handicaps as reading disabilities, problems of learning, conceptual problems, and perceptual difficulties.

The Oklahoma State Department of Education (1976) defines children with learning disabilities as "those children with normal or potentially normal intelligence who because of some neuro-psychological factor are noted

to have learning disabilities of a perceptual, conceptual, or integrative nature."

Learning Disabilities and Functioning on the WISC

Spache's (1957) study of one hundred children and adolescents with problems of learning indicated sixty-six had High Performance IQ scores as compared to Low Verbal IQ scores on the WISC. Graham's (1952) study revealed that sixty-one percent of disabled readers had higher performance scores than verbal scores. In this and other studies cited in this section, full scale IQ's were not restricted to the 90-110 range.

WISC profiles of one hundred fifty disabled readers were examined by Belmont and Birch (1966). After finding performance IQ scores high and verbal IQ scores low for disabled readers they concluded that disabled readers function better on performance tasks and less well on verbal tasks than non-disabled readers. Studying four groups of boys: well-adjusted disabled readers, poorly-adjusted disabled readers, well-adjusted non-disabled readers, and poorly-adjusted non-disabled readers, McLean (1964) found that disabled readers are significantly lower in verbal IQ scores than in performance IQ scores.

McDonald (1964) studied sixty male disabled readers using the Wechsler Adult Intelligence Scale (WAIS). One

third were high in verbal IQ and two thirds were high in performance IQ. The mean score difference between vocabulary and performance was 9.5 IQ points.

Of thirty-three children diagnosed as being disabled readers, of average or above IQ scores, thirteen had higher verbal scores and nineteen had higher performance scores in a study conducted by Paterra (1963). Ten of the thirty-three had fifteen-point differences between verbal and performance IQ scores on the WISC. Sawyer (1965) considered ninety midly disabled and ninety severely disabled readers each with normal or above IQ scores. Her data indicated that the WISC can be used for early identification of children and that severely disabled readers need radically different teaching methods.

Witkin, Dyk, Faterson, Goodenough, and Karp (1962) suggest regrouping the WISC subtests into three relatively independent factors. One factor is Verbal-Comprehension made up of the Vocabulary, Information, and Comprehension subtests. The second factor is Attention-Concentration comprised of the Arithmetic, Digit Span and Coding subtests. Third is the Analytical-Field-Approach factor made up of Object Assembly, Block Design, Picture Arrangement and Picture Completion subtests.

Ackerman, Peters, and Dykman (1971) after studying individual performance on the WISC subtests, cite attention

as a primary factor in learning disabilities. Results of a study by Keogh and Hall (1974) point out the importance of attention in learning problems. Utilizing the factor method of subtest analysis as proposed by Witkin, et. al., (1962), Keogh and Hall found consistently poor attention-concentration scores for learning disabled boys with average or better IQ scores. This analysis of WISC subtest patterns indicates the attentional characteristics among children who are failing in school.

Theoretical Framework

The theoretical framework for the present study is based primarily upon the work of Binet (1916), Terman (1937, 1960), and Wechsler (1949), as well as upon more recent research in the area of paired-associate learning such as that of Rohwer (1971, 1972), Brazziel (1969), Eisman (1958), and Ring and Palermo (1961).

Samuels and Anderson (1973) report that performance on intelligence tests and achievement in reading are related to one's ability to perform on a paired-associates task. The processes involved in a paired-associates learning task, according to Rohwer (1971), are conceptual and relate to reading achievement. Students can proceed from associative learning to abstract reasoning, says Brazziel (1969), if the instruction gradually brings them to this level. Rohwer (1972), however, found that

the underlying process in associative learning remains unchanged after the subject attains the age of four years.

The paired-associates techniques were used by Eisman (1958) in an early study of differences in learning, generalization, and retention between retarded, average, and superior groups of children. A series of seven pairs of pictures to be learned to a criterion of four consecutive, correct trials revealed no significant differences.

Ring and Palermo (1961) utilized eight pairs of Stanford-Binet vocabulary pictures in an attempt to investigate the relationship between level of intelligence and ability to learn paired-associates. Results of Ring and Palermo's study contradicted the earlier findings of Eisman. Ring and Palermo found that retarded subjects did not perform as well as normal individuals of the same chronological age. There was no significant difference, however, between the two groups of matched mental age.

Hiner (1962) found no significant difference in the rate of learning a paired-associates learning task among retarded, normal, and bright children. The conclusion was reached that something other than ability to learn was involved in the reading problems of the children in the study.

Welsh (1967) studied 216 boys and girls to determine effect of list length on the associative learning

ability of bright, normal, and retarded children. He found that the brights and normals did not perform significantly differently across the three list lengths, but the retardeds learned at a significantly slower rate in each of the two longer list length conditions. It was concluded that teachers need to recognize that many variables contribute to the retarded student's performance in any learning situation.

In a study of Indian and white children in second-, fourth-, and sixth- grades using the 16-Picture Paired-Associate Learning Task (PALT), Purdy (1968) reports the Indian children scored better than did their white counterparts in spite of the fact all of the subjects scored similarly on the Otis Quick-Scoring Mental Ability Test. Purdy concludes that the Indians in the study were innately brighter than their white counterparts, but because of deprived environmental backgrounds and probable poor positive attitudes towards their ability they did not function better on the Otis.

Prickett (1970) found no significant difference in learning rate on a 16-Picture PALT among 180 lower-white, lower-black, and high-white socioeconomic status second-, fourth-, and sixth-grade students of normal intellectual ability. The conclusion was reached that cultural differences do not affect learning rate of normal students on non-cultural learning tasks such as the

16-Picture PALT.

In a study using paired-associate tasks containing word pairs (nouns) administered to ten high school students diagnosed as learning disabled and ten normal college students, Prawat and Gaines (1974) found no significant difference in the learning strategies of the two groups. Prawat and Gaines state that the data they have gathered do not support the body of research that indicates paired-associate performance is related empirically to performance on achievement tests and complex mental activity in learners.

Based on the work of such researchers as Huelsman (1970) the present study used a Performance IQ/Verbal IQ scores psread of 15 points or greater on the WISC. From his research Huelsman concludes that high performance IQ scores in relation to low verbal IQ scores appear in about 60 percent of the disabled readers in most studies. In his own study Huelsman also found that of 101 disabled fourth grade readers 23 had a 15-point spread between their high performance IQ's scores and their low verbal IQ's scores. Only one of the 56 non-disabled readers in the study had such a spread.

The studies mentioned above provided the theoretical basis for this study and indicated the variables considered: verbal-performance IQ scores and associative learning rates. Female-male learning differences are not

a part of the above studies, but are unique to the present study.

Hypotheses Restated

The related literature reviewed in the current study was the basis for the hypotheses that there would be no statistically significant difference between the Trials-to-Criterion scores of the females and the Trials-to-Criterion scores of the males, nor would there be any statistically significant difference between the Errors-to-Criterion scores of the females and the Errors-to Criterion scores of the males. A review of related literature also served as the basis for the hypotheses that there would be no statistically significant differences among the Trials-to-Criterion scores of the High Verbal, High Performance, and No-Difference student groups, nor would there be any statistically significant differences among the Errors-to-Criterion scores of the High Verbal, High Performance, and No-Difference student groups. Finally, a study of related literature resulted in the hypotheses that there would be no statistically significant interaction between the two independent variables of Sex and Student Group as reflected in the Trials-to-Criterion scores of the six subgroups, nor would there be a statistically significant interaction between the two independent variables of Sex and Student Group

as reflected in the Errors-to-Criterion scores of the six subgroups.

CHAPTER III

Methods and Procedures

In the present study, sixty (N=60), eight-, nine-, and ten-year old children were given the Wechsler Intelligence Scale for Children (WISC) to determine their overall Intelligence Quotient (IQ) score and to determine the amount of discrepancy between their Verbal IQ score and their Performance IQ score. Students were then placed into one of three groups; High Verbal, (N=20), High Performance, (N=20), and No-Difference, (N=20), groups. These groups were further divided into male and female subgroups. Each group was then given the 16-Picture Paired-Associate Learning Task (PALT) to determine any differences among the various groups' associative learning rates when categorized along the dimensions of type of mental operation (High Verbal, High Performance, and No-Difference) and sex (male and female).

This chapter contains a detailed explanation of the methods and procedures used in conducting the study. These methods and procedures are divided into three phases of time orientation--Pre-Experimental procedures, Experimental or Data Collection Procedures, and Data Analysis Procedures. Each of these areas of procedures is explained in the following sections of the dissertation.

Pre-Experimental Procedures

The Pre-Experimental Procedures consisted of those tasks which were completed before the data were collected from the participants. The most important of those procecures are explained in the following sections.

Choice of Research Design

The first pre-survey procedure was to choose the proper research design for the conduct of the study. The words "research design" are intended to mean the plan, structure, and strategy of investigation conceived to obtain answers to research questions and to control external sources of variation. The Plan is the overall scheme or program of the evaluation problem; the Structure is the more specific structure or paradigm of the actual manipulation of the independent varibles being controlled; and the Strategy as used here is even more specific than the structure--it is the actual methods to be used in the gathering and analysis of the data.

A research design serves two basic purposes: (1) it provides answers to research questions posed by the investigator; and (2) it controls external sources (independent variables) of variation. In other words, it is through the design of a study that research is made effective and interpretable. Kerlinger makes the following statement in regard to research and evaluation designs:

> . . . How does design accomplish this? Research design sets up the framework for 'adequate' tests of the relations among variables. The design tells us, in a sense, what observations (measurements) to make, how to make them, and how to analyze the quantitative representations (data) of the observations. Strictly speaking, design does not 'tell' us precisely what to do, but rather suggests the directions of observation-making and analysis, how many observations should be made, and which variables (independent variables) are active variables and which are assigned. We can then act to manipulate (control) the active variables and to dichotomize or trichotomize or otherwise categorize the assigned variables. A design tells us what type of statistical analysis to use. Finally, an adequate (proper for the particular situation) design outlines possible conclusions to be drawn from the statistical analysis (pp. 196-97) (Parenthetical material added).

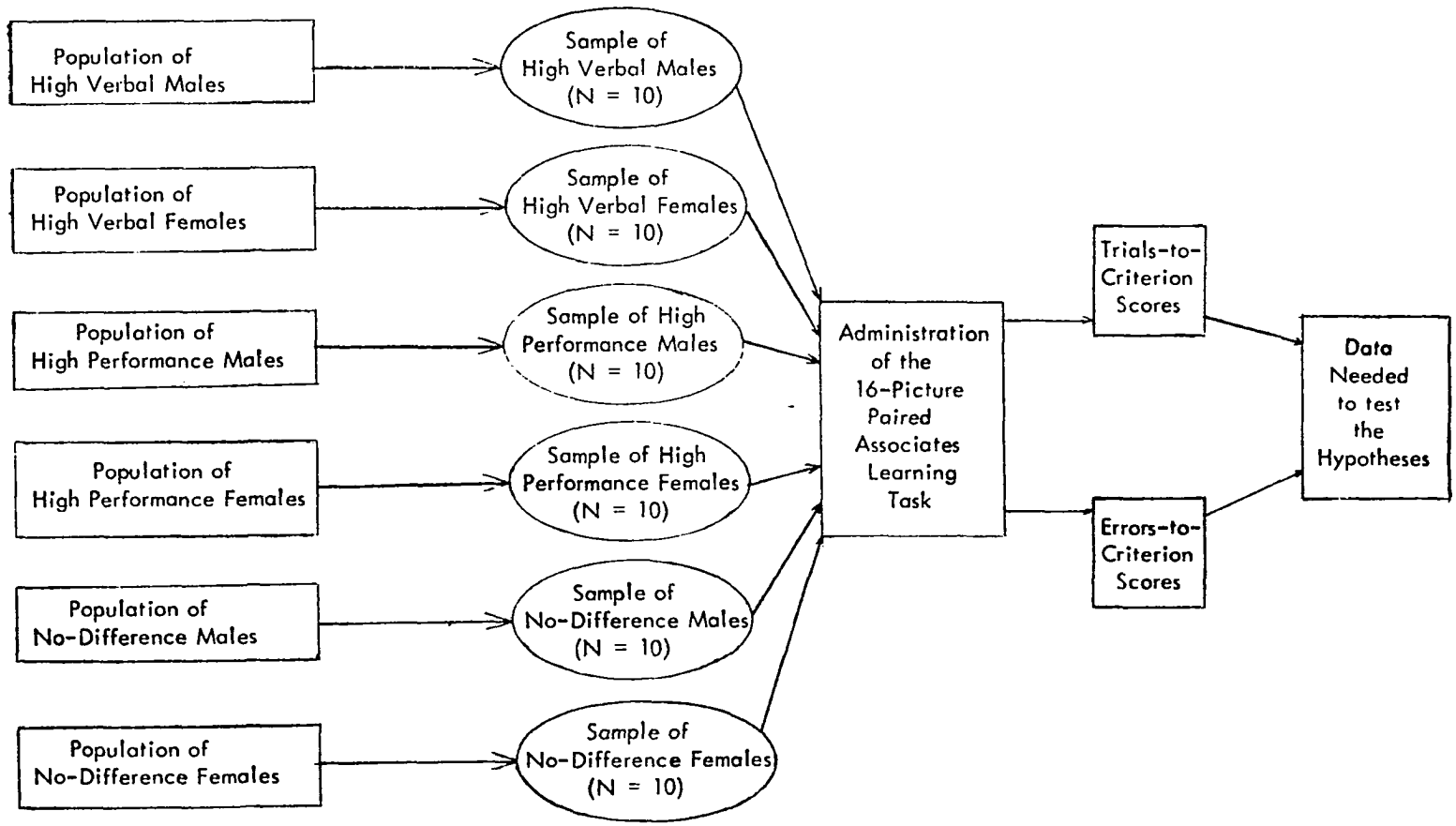
The research design chosen for the present experiment was a multiple-sample experimental research design preceded by the sampling of participants from six (6) finite populations. A paradigm of this research design is presented in figure 1.

Choice of Student Participants

The population of participants was limited to eight-, nine-, and ten-years old students who were enrolled in elementary schools in two separate regions being served by two of Oklahoma's Regional Education Service Centers during the 1975-76 school year. One way these Service Centers assist local school systems is by administering tests of individual intelligence to students who are experiencing academic difficulties to determine whether they qualify

Figure 1

RESEARCH DESIGN USED IN THE INVESTIGATION



for Special Education classes within the school system. One of the most important criteria for determining a particular type of learning disability is by observing a large discrepancy between the childs' Verbal and Performance IQ scores on the Wechsler Intelligence Scale for Children (Paterra, 1963). No definite amount of verbal/performance discrepancy has been established for determining learning disabilities, but a difference of fifteen or more IQ points is considered to indicate a possibly servere learning disability. These were the criteria used to determine the High Verbal group, those whose verbal IQ scores were at least 15 points higher ($\geq$ 15) than their Performance IQ scores. The High Performance Group was composed of those students whose performance IQ scores were at least fifteen points higher ($\geq$ 15) than their verbal IQ points. The No-Difference Group contained students who showed less than five points ($<$ 5) difference (discrepancy) between their Verbal and Performance IQ scores.

The investigator scanned files of several students before ten students could be correctly classified in each of the six subgroups. Actually twelve students were chosen for each subgroup to allow for subject attrition. Some students were later eliminated from the testing procedures. Selection of the twelve students for each subgroup involved a procedure which also lent

itself to securing a more homogeneous population. Students nearest chronological age nine years, six months, projected median subject age for the study, were retained as subjects. The process was later repeated to permit further elimination and reduce each subgroup to ten subjects each.

Instrumentation

Two instruments were used in the experiment. Each of these is described in the following sections.

The Wechsler Intelligence Scale for Children

The individual test of intelligence chosen for the preliminary screening of the applicants was the Wechsler Intelligence Scale for Children (WISC) (Wechsler, 1949).

The Wechsler Intelligence Scale for Children (WISC) was prepared as a downward extension of the original Wechsler-Bellevue (Seashore, Wesman, & Doppelt, 1950). Many items were taken from the Wechsler-Bellevue, easier items of the same types being added to each test. The WISC consists of twelve subtests, of which two are to be used either as alternates or as supplementary tests if time permits. As in the other Wechsler scales, the subtests are grouped into a Verbal and a Performance Scale, as follows:

	Verbal Scale		Performance Scale
1.	General Information	7.	Picture Completion
2.	General Comprehension	8.	Picture Arrangement
3.	Arithmetic	9.	Block Design
4.	Similarities	10.	Object Assembly
5.	Vocabulary	11.	Coding
6.	Digit Span (Optional)	12.	Mazes (Optional)

The tests listed as alternates were those giving the lowest correlations with the rest of the scale. In the Verbal Scale, Digit Span proved to be the least satisfactory test and was, therefore, designed as alternate. In the Performance Scale, either Coding or Mazes may be omitted, the decision being left to the examiner.

Reliability of the Wechsler Intelligence Scale for Children (WISC)

The split-half reliability co-efficients for eight-, nine-, and ten-years old students are listed in Table 1.

Validity of the Wechsler Intelligence Scale for Children (WISC)

The authors of the Wechsler Intelligence Scale for Children (WISC) do not discuss validity as such, but instead give the correlation of WISC scores with other measures of intelligence. The correlations of the WISC scores with the Stanford-Binet Test of Individual Intelligence are as follows:

Verbal/Verbal; r = .071
Performance/Performance; r = 0.60
Full Scale/Full Scale; r = 0.73

The correlation of WISC scores with other measures

TABLE 1

SPLIT-HALF RELIABILITY COEFFICIENTS BY SUBTEST FOR EIGHT-, NINE-, AND TEN-YEAR OLD STUDENTS

Subtest	AGE GROUP		
	8	9	10
Information	.80	.81	.83
Similarities	.79	.79	.79
Arithmetic	.69	.80	.76
Vocabulary	.86	.86	.84
Comprehension	.73	.78	.71
Digit Span	--- [a]	--- [a]	.71
Picture Completion	.86	.78	.68
Picture Arrangement	.69	.76	.72
Block Design	.85	.80	.86
Object Assembly	.66	.70	.64
Coding	--- [a]	--- [a]	.76
Mazes	.77	.71	.66
Verbal IQ	.92	.94	.93
Performance IQ	.91	.91	.89
Full Scale IQ	.95	.96	.95

Note: The reliability coefficients for all tests except Digit Span and Coding are split-half correlations corrected by the Spearman-Brown formula. For Digit Span and Coding, test-retest correlations are presented for six age groups; these coefficients, which are based on samples of about 50 children tested twice (1-month interval), were corrected for the variability of the appropriate norms group.

a: Not available.

Reproduced from the Manual for administering the Wechsler Intelligence Scale for Children

of intelligence developed by Wechsler and his associates are as follows:

> Correlation of the WISC and the Wechsler Pre-School and Primary Scale of Intelligence (WPPSI)
>
> Verbal/Verbal; r = 0.80
> Performance/Performance; r = 0.82
> Full Scale/Full Scale; r = 0.82
>
> Correlation of the WISC with the Wechsler Adult Intelligence Scale (WAIS)
>
> Verbal/Verbal; r = 0.96
> Performance/Performance; r = 0.83
> Full Scale/Full Scale; r = 0.95

The validity figures shown for the WISC are sufficient for measuring the mental functioning of the students participating in the study.

The 16-Picture Paired-Associates Learning Task

The second instrument used in the investigation was the 16-Picture Paired-Associates Learning Task (PALT). This instrument was used as a means of measuring the associative learning rates of the students participating in the study.

The PALT was utilized in previous research studies by Hiner (1962), Welsh (1967), Purdy (1969), and Prickett (1970). These researchers found the PALT to be valid and reliable instrument for measuring associative learning rates.

The 16-Picture Paired-Associates Learning Task

(PALT) is comprised of 16 pairs of line drawings depicting easily identified domestic animals, items, and scenes. The first of two items is presented to the subject. When the second item is presented, the subject is asked to make the association. All 16 pairs are presented in the same fashion. Pairs of items are presented until the subject can correctly respond to the stimulus items two times in succession. A copy of the instrument is presented in Appendix A.

Reliability of the 16-Picture Paired-Associates Learning Task (PALT)

Prickett (1970) attempted to establish the reliability of the 16-Picture PALT. The internal consistency measure of the instrument was computed by using the Kuder-Richardson Formula 8 (Kuder & Richardson, 1937) for estimating test reliability from the variance of the total test scores and the sum of the item variances. The calculated reliability of the 16-Picture PALT is presented in table 2. The total test reliability for all 16 pairs of associates was determined to be $r = 0.785$.

Validity of the 16-Picture Paired-Associates Learning Task

The concurrent validity of the 16-Picture PALT has been calculated and reported by several researchers. Prickett (1970) compared the Trials-to-Criterion scores of 180 students who had been given the PALT to their

TABLE 2

INTERNAL-CONSISTENCY (RELIABILITY) OF THE 16 PICTURE PAIRED-ASSOCIATES LEARNING TASK

Items	Internal Consistency Coefficients (N = 180)		
	Item-Test Correlation	Mean	s. d.
1	.72	2.29	.82
2	.87	3.14	1.02
3	.74	3.48	.96
4	.71	4.87	1.37
5	.69	4.75	.83
6	.86	4.00	1.27
7	.91	4.70	1.06
8	.73	5.04	1.53
9	.56	3.63	.94
10	.79	3.41	.78
11	.77	4.96	1.29
12	.92	2.98	.71
13	.94	3.42	.98
14	.61	3.34	.89
15	.67	4.04	1.21
16	.53	2.63	.64

Source: Table 2 is reproduced from Table 22 of a Doctoral Dissertation; The Associative Learning Rates of Second, Fourth, and Sixth Grade Black and White Students with a Socioeconomic Difference, by J. L. V. Prickett, The University of Oklahoma, 1970, (p. 124) (Reproduced with permission of the author).

IQ scores from the Stanford-Binet Intelligence Scale. This validity index was reported to be as follows:

PALT/Full Scale; r = 0.412

The validity index reported in this study was sufficient for measuring the associative learning rates of the student participants. The 16-Picture PALT does not result in an IQ score since it measures only one major dimension of intellectual functioning; therefore, it should not be expected to correlate highly with the Stanford-Binet. However, the PALT has prima facie validity.

Experimental Procedures

Each subject was administered the 16-Picture Paired-Associates Learning Task (PALT) in a room or other testing situation which was isolated from the normal flow of school activity. If the testing session was interrupted and there was good reason to believe that the subject's thought pattern was disrupted, the subject was dropped from the study. All tests were given by the investigator, and the testing procedures were completed within a nine-week time span. These procedures tended to eliminate any contamination due to different experimenters or maturation (i.e., confounding caused by additional maturation/development of the subjects over an extended period of time).

Directions for Administration

The following instructions were given to each subject:

> Here are a number of cards (the Examiner opens Booklet One). Each card in this set has two pictures on it (the Examiner shows the subject the sample pair). Look at both pictures carefully and try to remember which two pictures go together. (The Examiner then closes Booklet One and shows the subject Booklet Two). Then I will show you another set of cards like these with only the first picture showing (the Examiner shows the sample card). I want you to tell me what picture went with this picture. (The Examiner pauses for the answer). So, as you see the two pictures together, try to remember what two pictures went together (Hiner, 1962, p. 18).

If the subject failed to answer the sample card correctly, the examiner restated the appropriate instructions, repeating the example until he was satisfied the subject understood the nature of the task.

Then, the paired pictures were presented singly to each subject at the rate of one every three seconds. Following this, Booklet Two was opened and the first picture of each pair was presented singly at the rate of one every five seconds. The examiner scored each oral response made by the subject using the response sheet shown in Appendix B. Additional trials were then administered until the subject reached the learning criterion of two successive, correct repetitions of the list. No ceiling was placed on the number of trials or errors the students could experience. Intertrial intervals were ten

seconds in length. Between trials and examiner said: "Now we will look at the pictures again. Try to remember what two pictures were together" (Hiner, 1962, p. 19). If the subject questioned the examiner about the test, he added: "We will keep looking at the pairs of pictures until you learn all of them" (Hiner, 1962, p. 19).

The researcher used a typed instruction sheet each time the test was administered as a means of standardizing the procedures. The Trials-to-Criterion and Errors-to-Criterion were recorded on the individual record sheet. This record sheet contained the subject's number, grade, school, date examined, Trials-to-Criterion, number of errors for each trial, and the subject's age (Appendix B).

Data Analysis Procedures

The data analysis procedures represented the final phase of the methods and procedures used in conducting the experiment. These procedures began after the data had been collected.

The first data analysis procedure was the scoring and tabulation of students' responses to the 16 Picture Paired-Associates Learning Task (PALT). This resulted in three scores for each participant -- the Trials-to-Criterion score, the Errors-to-Criterion score, and the Passes-to-Criterion score. The first two were used in

the statistical calculations made while testing the hypotheses.

Statistical Calculations

The statistical calculations were the next step of the data analysis procedures. This involved the calculation of descriptive statistics for each subgroup's data. The mean ($\bar{X}$), standard deviation (S), and variance (S^2) were calculated for each group. These statistics can be seen in the Appendices along with the raw data.

The actual testing statistic was a two-way analysis of variance (ANOVA) for a fixed effects design. This testing statistic yields three F values as follows; (1) one for the main effect of Sex, (2) one for the main effect of Student Group, and (3) one for the interaction effects of the two groups. Both the Errors-to-Criterion and Trials-to-Criterion scores were compared with this same statistical treatment.

Significant F values were followed by Post Hoc comparisons in an attempt to locate specific areas of mean difference. The Newman-Keuls Test (Kirk, 1970) was the range test chosen for making these comparisons in the present study.

CHAPTER IV

RESULTS OF DATA ANALYSIS

The responses of sixty (N=60) eight-, nine-, and ten-years old children to the 16-Picture Paired-Associates Learning Task (PALT) were analyzed to determine if there were significant differences among the associative learning rates of children who were of average intelligence but who had different types of mental functioning. A two-way analysis of variance (ANOVA) testing statistic was used to compare the Trials-to-Criterion scores and Errors-to-Criterion scores of twenty (N=20) children in the High Verbal group (those children whose Verbal IQ scores were fifteen or more points higher than their Performance IQ scores), High Performance group (those children whose Performance IQ scores were fifteen or more points higher than their Verbal IQ scores), and No-Difference group (those children whose Verbal and Performance IQ scores were no more than five points apart).

Six null hypotheses were tested for significance at the .05 level of confidence. These hypotheses were concerned with differences among the various groups' Errors-to-Criterion scores and Trials-to-Criterion scores.

This Chapter of the dissertation contains the results of testing the hypotheses. Ancillary data are also

presented and the Chapter ends with a summary of the results.

Preliminary Analysis

The first preliminary analysis was concerned with the descriptive statistics of the groups' Trials-to-Criterion and Errors-to-Criterion scores. The means ($\bar{X}$) and standard deviations (S) of the groups scores are presented in Table 3. The raw scores used in calculating the descriptive statistics are presented in the appendices.

It was necessary to make preliminary comparisons among the subgroups' variances. This was done in order to determine the homogeneity of sample variances, since the analysis of variance testing statistic assumes homogeneity of the variances being compared. The test used to make this preliminary comparison was the F-Maximum Test for Homogeneity of Sample Variance (Bruning & Kintz, 1970). This test is performed simply by determining the ratio of the smallest sample variance to the largest sample variance.

$$\text{F-Maximum} = \frac{\text{Largest Sample Variance}}{\text{Smallest Sample Variance}}$$

The variances of the student groups and subgroups are presented in Table 4. This Table also shows the results of the homogeneity comparisons.

The data presented in Table 4 show that all group

TABLE 3

MEANS AND STANDARD DEVIATIONS OF THE GROUPS' TRIALS-TO-CRITERION AND ERRORS-TO-CRITERION SCORES

	MALES		FEMALES		TOTALS	
	Trials	Errors	Trials	Errors	Trials	Errors
High-Verbal Group	$\overline{X}$ = 7.40 S = 2.54	$\overline{X}$ = 39.60 S = 14.37	$\overline{X}$ = 6.20 S = 1.54	$\overline{X}$ = 35.60 S = 13.68	$\overline{X}$ = 6.80 S = 2.18	$\overline{X}$ = 37.60 S = 17.93
High-Performance Group	$\overline{X}$ = 7.70 S = 1.79	$\overline{X}$ = 43.70 S = 12.43	$\overline{X}$ = 7.00 S = 1.55	$\overline{X}$ = 43.70 S = 14.71	$\overline{X}$ = 7.35 S = 1.71	$\overline{X}$ = 43.70 S = 13.62
No-Difference Group	$\overline{X}$ = 7.80 S = 3.89	$\overline{X}$ = 52.30 S = 15.06	$\overline{X}$ = 7.40 S = 2.01	$\overline{X}$ = 41.50 S = 12.08	$\overline{X}$ = 7.60 S = 3.11	$\overline{X}$ = 46.90 S = 14.58
TOTALS	$\overline{X}$ = 7.63 S = 2.88	$\overline{X}$ = 45.20 S = 13.23	$\overline{X}$ = 6.87 S = 1.78	$\overline{X}$ = 40.27 S = 14.50	$\overline{X}$ = 7.25 S = 2.43	$\overline{X}$ = 42.73 S = 16.38

TABLE 4

A COMPARISON OF THE VARIANCES OF STUDENT GROUPS AND SUBGROUPS

	Variances of Trials-to-Criterion Scores			Variances to Errors-to-Criterion Scores		
	Highest Variance	Lowest Variance	F-Value	Highest Variance	Lowest Variance	F-Value
Sex	8.30	3.18	2.61	210.2	174.9	1.20
Student Group	9.64	2.92	3.30	286.2	184.1	1.55
Subgroup	15.16	2.36	6.42	226.8	145.9	1.55

and subgroup variances were statistically homogeneous, and the assumptions underlying the two-way analysis of variance testing statistic were met. This allowed the data analysis procedures to continue.

Results of Testing Hypothesis Number One

The first null hypothesis was concerned with the Trials-to-Criterion scores of the males and females. The null form of the first hypothesis was tested as follows:

Ho_1 There is no statistically significant difference between the Trials-to-Criterion scores of the females and the Trials-to-Criterion scores of the males.

The first null hypothesis was tested by comparing the Trials-to-Criterion scores of the thirty (N=30) male students with the Trials-to-Criterion scores of the thirty (N=30) female students. This was accomplished through the use of a two-way analysis of variance testing statistic. The results of these calculations appear as the first F value in Table 5.

The results presented in Table 5 show that there was not a significant difference between the Trials-to-Criterion scores of the male students and the Trials-to-Criterion scores of the females ($F = 1.306$, $df=1/54$; $p > .05$). These results would not allow the researcher to reject the first null hypothesis, and the alternative was accepted.

TABLE 5

RESULTS OF TWO-WAY ANALYSIS OF VARIANCE COMPARING THE GROUPS' TRIALS-TO-CRITERION SCORES

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F-Value
A - Sex	8.813	1	8.813	1.306
B - Student Group	6.700	2	3.350	0.538
A X B Interaction	4.987	2	2.494	0.401
Within (Error)	336.100	54	6.224	
TOTAL	353.25	59		

Results of Testing Hypothesis Number Two

The second null hypothesis was concerned with the Trials-to-Criterion scores of the IQ groups. The null form of the second hypothesis was tested as follows:

Ho_2 There is no statistically significant difference among the Trials-to-Criterion scores of the High-Verbal, High-Performance, and No-Difference student groups.

The second null hypothesis was tested by comparing the Trials-to-Criterion scores of the twenty (N=20) students in the High-Verbal group, the Trials-to-Criterion scores of the twenty (N=20) students in the High-Performance group, and the Trials-to-Criterion scores of the twenty (N=20) students in the No-Difference group. This was accomplished through the use of a two-way analysis of variance testing statistic. The results of these calculations appear as the second F value in Table 5.

The results presented in Table 5 show that there was not a significant difference among the Trials-to-Criterion scores of the three IQ groups ($F = 0.538$; $df=2/54$; $p > .05$). These results would not allow the researcher to reject the second null hypothesis.

Results of Testing Hypothesis Number Three

The third null hypothesis was concerned with the interaction of the Sex and Student IQ Group. The null

form of the third hypothesis was tested as follows:

Ho_3 There is no statistically significant interaction between the two independent variables of Sex and Student IQ Group as reflected in the Trials-to-Criterion scores of the six subgroups.

The third null hypothesis was tested by comparing the Trials-to-Criterion scores of the ten (N=10) individuals within each of the six subgroups. This was accomplished through the use of a two-way analysis of variance testing statistic, and appears as the third *F* value in Table 5.

The results presented in Table 5 show that there was not a significant interaction between the two independent variables of Sex and Student IQ Group ($F = 0.401$; $df=2/54$; $p > .05$). These results would not allow the researcher to reject the third null hypothesis.

Results of Testing Hypothesis Number Four

The fourth null hypothesis was concerned with the Errors-to-Criterion scores of the Males and Females. The null form of the fourth hypothesis was tested as follows:

Ho_4 There is no statistically significant difference between the Errors-to-Criterion scores of the females and the Errors-to-Criterion scores of the males.

The fourth null hypothesis was tested by comparing the Errors-to-Criterion scores of the thirty (N=30) male students with the Errors-to-Criterion scores of the

thirty (N=30) female students. This was accomplished through the use of a two-way analysis of variance testing statistic. The results of these calculations appear as the first F value in Table 6.

The results presented in Table 6 show that there was no significant difference between the Errors-to-Criterion scores of the males and the Errors-to-Criterion scores of the females ($F = 0.843$, $df=1/54$; $p > .05$). These results would not allow the researcher to reject the fourth hypothesis.

Results of Testing Hypothesis Number Five

The fifth null hypothesis was concerned with the Errors-to-Criterion scores of the IQ groups. The null form of the fifth hypothesis was tested as follows:

Ho_5 There are no statistically significant differences among the Errors-to-Criterion scores of the High Verbal, High Performance, and No-Difference student IQ group.

The fifth null hypothesis was tested by comparing the Errors-to-Criterion scores of the twenty (N=20) students in the High-Verbal group, the Errors-to-Criterion scores of the twenty (N=20) students in the High-Performance group, and the Errors-to-Criterion scores of the twenty (N=20) students in the No-Difference group. This was accomplished through the use of a two-way analysis of variance testing statistic. The results of

TABLE 6

RESULTS OF TWO-WAY ANALYSIS OF VARIANCE COMPARING THE GROUPS' ERRORS-TO-CRITERION SCORES

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F-Value
A - Sex	365.07	1	365.07	0.843
B - Student Group	892.94	2	446.47	1.031
A X B Interaction	298.13	2	149.07	0.344
Within (Error)	23,393.86	54	433.22	
TOTAL	24,950.00	59		

these calculations appear as the second F value in Table 6.

The results presented in Table 6 show that there was not a significant difference among the Errors-to-Criterion scores of the three student IQ groups ($F = 1.031$, $df=2/54$; $p > .05$). These results would not allow the researcher to reject the fifth null hypothesis.

Results of Testing Hypothesis Number Six

The sixth null hypothesis was concerned with the interaction of the Sex and Student IQ Group. The null form of the sixth hypothesis was tested as follows:

Ho_6 There is no statistically significant interaction between the two independent variables of Sex and Student IQ Group as reflected in the the Errors-to-Criterion scores of the six subgroups.

The sixth null hypothesis was tested by comparing the Errors-to-Criterion scores of the ten (N=10) individuals within each of the six subgroups. This was accomplished through the use of a two-way analysis of variance testing statistic, and appears as the third F value in Table 6.

The results presented in Table 6 show that there was not a significant interaction between the two variables of Sex and Student IQ Group as reflected in the Errors-to-Criterion scores ($F = 0.344$, $df=2/54$; $p >$

.05). These results would not allow the researcher to reject the sixth null hypothesis.

Secondary Findings

The results of testing the hypotheses showed that none could be rejected. These results did show a trend, however, that had not been expected. It had been anticipated and supported by theory that verbal ability would correspond with associative learning rates. (i. e. those students having the highest Verbal IQ scores would have the lowest Trials-to-Criterion scores and the lowest Errors-to-Criterion scores, while students with the lowest Verbal IQ scores would have the highest Trials-to-Criterion scores and the highest Errors-to-Criterion scores.) This was not the case, however. The High-Verbal group had the lowest Trials-to-Criterion scores and lowest Errors-to-Criterion scores, but the lowest verbal group (High-Performance group) had lower Trials-to-Criterion scores and lower Errors-to-Criterion scores than the No-Difference group. To further explain this phenomenon, the IQ scores and scores from the 16-Picture Paired-Associates Learning Task (PALT) are presented in Table 7. The data presented in this Table show that the High-Performance group performed better on the 16-Picture Paired-Associates Learning Task (PALT) than the No-Difference group. While the differences between

TABLE 7

IQ SCORES AND TRIALS-TO-CRITERION AND ERRORS-TO-CRITERION SCORES OF THE THREE STUDENT IQ GROUPS

Measurement Areas	Student IQ Groups		
	High Verbal	High Performance	No-Difference
Average Verbal IQ Score	110.85	86.60	100.80
Average Performance IQ Score	89.55	108.25	101.40
Average Total IQ Score	100.80	96.50	101.25
Average Trials-to-Criterion Score	6.80	7.35	7.60
Average Errors-to-Criterion Score	37.60	43.70	46.90

the two groups' scores were not significant, it should be noted that the High-Performance group are by definition Learning Disabled, while the No-Difference group is regarded to be "Normal." In light of this fact, the No-Difference group should have performed much better than the High-Performance group, but this was not the case. At this point there seems to be no logical or theoretical explanation for the performance of the No-Difference and High-Performance groups, but several possibilities are discussed in Chapter V.

Summary of Results

Six null hypotheses were tested in the present study. Three were concerned with students' Trials-to-Criterion scores and three were related to students' Errors-to-Criterion scores on the 16-Picture Paired-Associates Learning Task (PALT). The results of testing the first three were as follows:

1. There was no significant difference between the Trials-to-Criterion scores of Male and Female students.

2. There were no significant differences among the High-Verbal, High-Performance and No-Difference groups' Trials-to-Criterion scores.

3. There was no significant interaction between the two independent variables of Sex and Student IQ group as reflected in the participants' Trials-to-Criterion scores.

The final three hypotheses were concerned with the students' Errors-to-Criterion scores. The results of testing these hypotheses were as follows:

1. There was no significant difference between the Errors-to-Criterion scores of the Male and Female students.

2. There were no significant differences among the High-Verbal, High-Performance, and No-Difference groups' Errors-to-Criterion scores.

3. There was no significant interaction between the two independent variables of Sex and Student IQ group as reflected in the participants' Errors-to-Criterion scores.

The secondary findings showed that the "Learning Disability" students (High-Performance group) performed much better on the PALT than the "Normal" students (No-Difference group).

CHAPTER V

SUMMARY, CONCLUSIONS, AND IMPLICATIONS FOR FURTHER RESEARCH

The purpose of the present study was to compare the associative learning rates of female and male students grouped by types of "mental operations." The researcher compared the associative learning rates of female and male students having high-verbal/low-performance IQ scores with the associative learning rates of students having low-verbal/high-performance IQ scores, and students having little difference between their verbal and performance IQ scores.

White (Anglo) eight-, nine-, and ten-years old elementary students from two geographical regions of Oklahoma were administered the 16-Picture Paired-Associates Learning Task (PALT). The participant population was limited to sixty (N=60) students whose Full Scale IQ scores on the Wechsler Intelligence Scale for Children (WISC) were within the 90-110 range. Of this population twenty (N=20) students had a High-Verbal/Low-Performance WISC IQ score discrepancy of fifteen or greater points ($\geq$ 15). This group was designated as the High-Verbal group. An additional twenty (N=20) students had a Low-Verbal/High-Performance WISC IQ score

discrepancy of fifteen or greater points ($\geq$ 15). This group was designated as the High-Performance group (N=20). The remaining twenty (N=20) students in the study had a Verbal/Performance IQ score discrepancy on the WISC of less than five points (<5) and were designated as the No-Difference (No-Discrepancy) group (N=20). Each of the three primary groups were further divided into female (N=10) and male (N=10) subgroups.

Administrating the 16-Picture PALT resulted in a Trials-to-Criterion score and an Errors-to-Criterion score for each participating student. The mean Trials-to-Criterion score and the mean Errors-to-Criterion score for each of the six (6) subgroups were compared in an attempt to determine possible differences among the groups' associative learning rates. A two-way analysis of variance (ANOVA) was used to compare the associative learning rates of the six subgroups and to test the six hypotheses stated in Chapter I. The essence of these hypotheses was to determine any significant differences which may exist among the associative learning rates of the six subgroups of High-Verbal Females, High-Verbal Males, High-Performance Females, High-Performance Males, No-Discrepancy Females, and No-Discrepancy Males.

The results of testing the null hypotheses showed that there was no statistically significant difference among the associative learning rates of the six subgroups.

However, the High-Verbal group learned more quickly than the No-Discrepancy group. Female subjects learned faster than their male counterparts in every category except in the Errors-to-Criterion designation of the High-Performance group where the functioning of female and male subjects resulted in equivalent means.

The conclusions drawn from the results are presented in the following sections.

CONCLUSIONS

The conclusions presented here are the major conclusions resulting from testing the hypotheses. Generalization of the results of the present study should be approached cautiously pending further research in the area.

Conclusion Number One

Results of testing the first hypothesis led to the conclusion that there was no real difference between the number of trials required by the males and females to make the sixteen pairs of picture associations.

Conclusion Number Two

The results of testing the second null hypothesis led to the conclusion that there was no real difference among the numbers of trials needed by the High-Verbal, High-Performance, and No-Difference (No-Discrepancy)

groups to make the sixteen pairs of picture associations.

Conclusion Number Three

The results of testing the third null hypothesis led to the conclusion that there was very little interaction between the students' Sex and Type of Mental Operation when considering the number of trials required to make the sixteen pairs of picture associations.

Conclusion Number Four

Results of testing the fourth null hypothesis led to the conclusion that there was no real difference between the number of errors experienced by the males and females in making the sixteen pairs of picture associations.

Conclusion Number Five

The results of testing the fifth null hypothesis led to the conclusion that there was no real difference among the number of errors experienced by the High-Verbal, High-Performance, and No-Difference (No-Discrepancy) groups in making the sixteen pairs of picture associations.

Conclusion Number Six

The results of testing the sixth null hypothesis led to the conclusion that there was very little interaction between the students' Sex and Type of Mental

Operation when considering the number of errors experienced in making the sixteen pairs of picture associations.

DISCUSSION

The learning theories used as the theoretical basis of the present study led to the logical hypothesis that students showing the highest verbal ability should be the most proficient in making picture associations, since verbal ability is usually equated with mental symbols and/or pictures. This should logically lead to the lowest Trials-to-Criterion and lowest Errors-to-Criterion scores. Conversely, students having the lowest verbal ability should be the least proficient in making picture associations, and have the greatest Trials-to-Criterion and Errors-to-Criterion scores.

The results of the study adhered to this theory only in part. The High-Verbal group required the lowest number of trials and experienced the lowest number of errors as expected. However, the High-Performance group required the next lowest number of trials and experienced the next lowest number of errors. The No-Difference group required the greatest number of trials and experienced the greatest number of errors of the three groups in spite of the fact that this group was well ahead of the High-Performance group in verbal ability. There are several possible explanations for this discrepancy.

Some of the more plausible are presented in the following sections.

It may be that a verbal/performance discrepancy causes the individuals in the High-Verbal group and the High-Performance group to perform better in associative learning rate than those in the No-Difference group. One possibility is that individuals in the High-Verbal and High-Performance groups have developed an "innate" ability to over compensate in the area of associative learning because they are experiencing problems in other areas of the basic learning process.

IMPLICATIONS FOR FURTHER RESEARCH

Results of this investigation, as well as the review of literature, validated the appropriateness of the hypotheses formulated. The fact that the two groups with verbal/performance IQ score discrepancy functioned better on associative learning rates in spite of each being at opposite ends of the continuum of verbal ability indicates a need for further research in this area.

One possible study would be a replication of the present study with changes in the associative learning instrument. For instance, nonsense syllables or numbers could be substituted for the pictures to formulate the pairs of associations. This would possibly introduce an entirely different dimension into the study, because

abstract symbols would be utilized rather than the more concrete pictures of common, everyday items and animals. The function of reading and performing related academic activities relies heavily upon the individual's ability to handle abstract symbols. Consequently, replacing pictures of concrete items and animals with abstract symbols might provide a greater distinction and insight into the associative learning rates of the three varying verbal ability groups.

Further studies could be conducted utilizing six-, nine-, twelve-, and fifteen-years old subjects instead of the age groups represented in the present study. In addition to providing a broader population base, the results would help determine the effects of developmental level (or age) on associative learning rates.

Another possible study might involve changing the design of the present study. Actual implementation of the associative learning process would take place, but would include a pretest and posttest of associative learning rates. Serial learning of the items on the paired-associates task could be eliminated by presenting the pairs of associates in random order.

One final implication for further research would be to change the study as implemented in its present form, but retain the same subjects. This could serve as a means of exploring other similarities, differences, and

relationships existing among the six subgroups utilized in the present study.

Individuals involved in conducting student evaluations to determine the learning needs, optimum student placement for instruction, and most effective learning plans and media are being challenged more and more frequently on accuracy and effectiveness of the diagnoses they make. This study of the associative learning rates of students having high-verbal/low-performance IQ scores as compared with students having low-verbal/high-performance IQ scores and students having little verbal/performance discrepancy was an effort to provide empirical data on one area of learning--associative learning and how it relates to verbal/performance mental abilities.

The results of this study can be beneficial to psychometrists, psychologists, prescriptive teachers, and other educators involved in the education of children with specific learning disabilities. The present study may contribute to research on utilizing the learning capabilities and techniques possessed by a specific child who seems to be unable to learn by the more standard procedures. Finally, the study may be an impetus to other researchers to explore related areas of the learning process.

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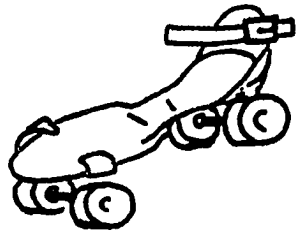
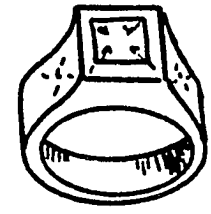
APPENDIX A

THE 16-PICTURE PAIRED-ASSOCIATES LEARNING TASK (PALT) USED IN THE STUDY

Sample Pair X





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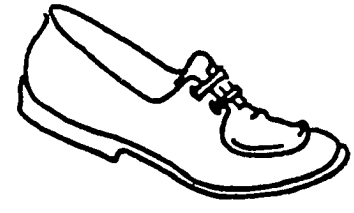

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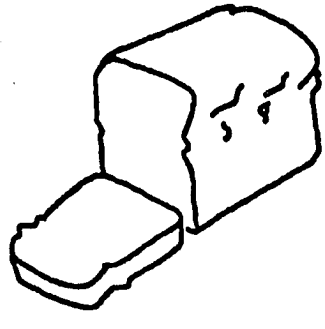

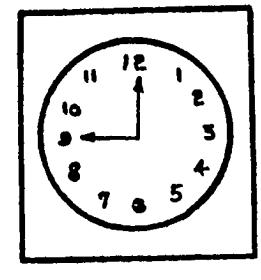

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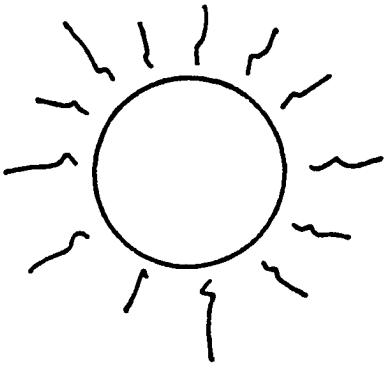

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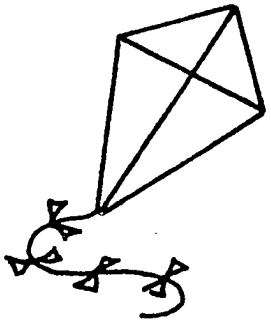

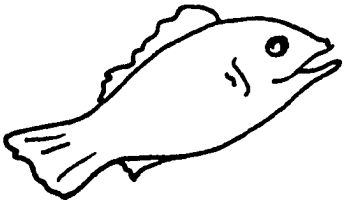

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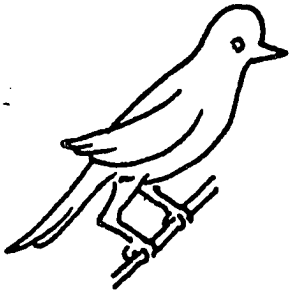

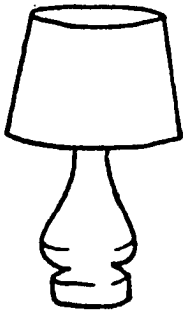

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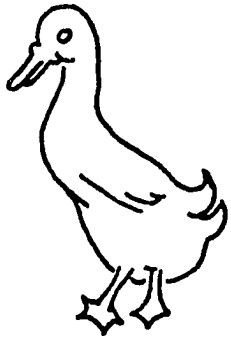

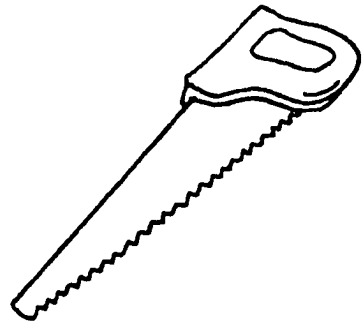

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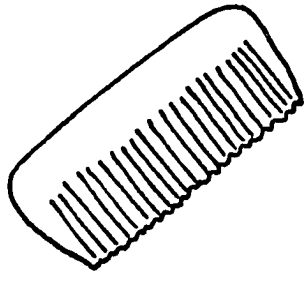

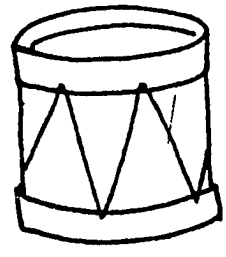

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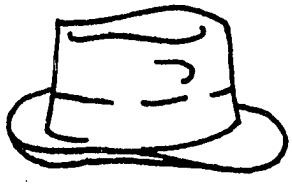

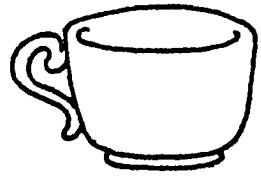

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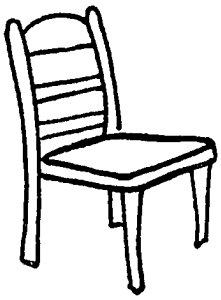

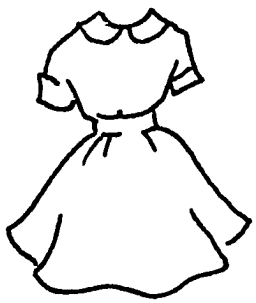

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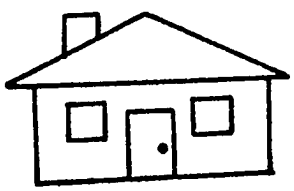

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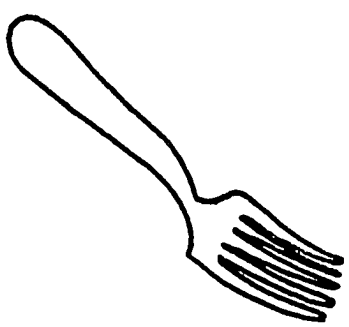

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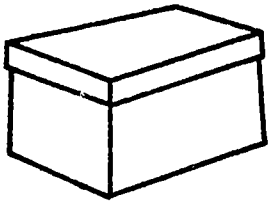

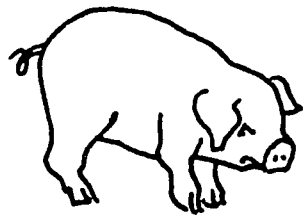

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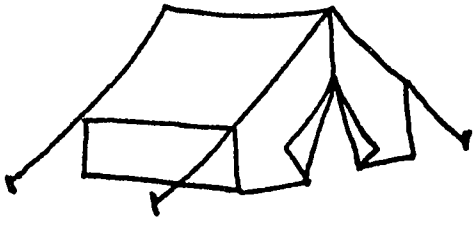

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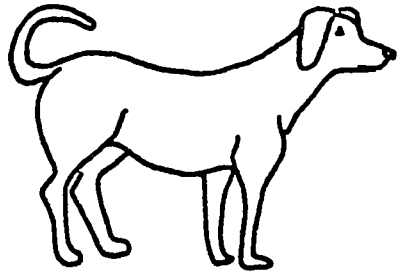

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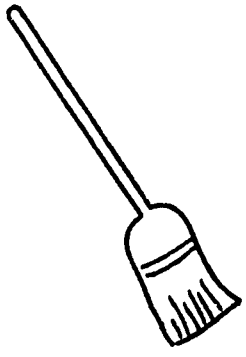

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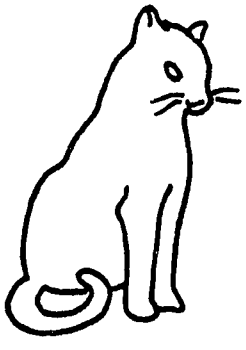

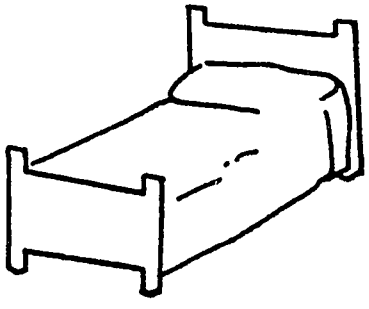

APPENDIX B

ANSWER DOCUMENT FOR RECORDING STUDENTS' RESPONSES TO THE 16-PICTURE PAIRED-ASSOCIATES LEARNING TASK (PALT)

INDIVIDUAL RECORD SHEET

Name:_____ Grade Level:_____

Age:_____ School:_____

Examiner:_____ Date:_____

PAIRS

TRIALS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
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APPENDIX C

AGE, VERBAL, PERFORMANCE, AND TOTAL IQ SCORES OF PARTICIPANTS

TABLE 8

AGES AND INTELLIGENCE SCORES OF MALES IN THE HIGH VERBAL GROUP

Subject Number	Age yrs.	Age mos.	Verbal I.Q. Scores	Performance I.Q. Scores	Full Scale I.Q. Scores
1.	9	3	116	96	107
2.	9	10	109	92	101
3.	8	6	114	89	102
4.	8	0	110	82	96
5.	10	5	113	92	104
6.	10	6	106	90	99
7.	8	0	119	94	108
8.	10	9	108	92	100
9.	8	1	103	85	93
10.	10	0	110	90	101
Mean	9	4	110.80	90.20	101.10
Standard Deviation			4.53	3.92	4.35

TABLE 9

AGES AND INTELLIGENCE SCORES OF FEMALES
IN THE HIGH VERBAL GROUP

Subject Number	Age yrs.	Age mos.	Verbal I.Q. Scores	Performance I.Q. Scores	Full Scale I.Q. Scores
1.	10	8	101	82	91
2.	10	2	116	100	109
3.	8	0	113	87	101
4.	8	5	100	82	91
5.	9	2	111	93	103
6.	8	0	121	93	109
7.	8	4	105	78	91
8.	10	1	105	83	94
9.	9	4	113	97	106
10.	10	5	124	94	110
Mean	9	3.1	110.90	88.90	100.50
Standard Deviation			7.71	7.22	7.65

TABLE 10

AGES AND INTELLIGENCE SCORES OF MALES
IN THE HIGH PERFORMANCE GROUP

Subject Number	Age		Verbal I.Q. Scores	Performance I.Q. Scores	Full Scale I.Q. Scores
	yrs.	mos.			
1.	8	3	87	106	94
2.	10	3	91	106	98
3.	9	4	97	113	106
4.	9	9	91	120	105
5.	9	9	91	110	100
6.	8	1	92	111	101
7.	9	8	81	109	93
8.	10	4	82	107	93
9.	9	7	77	107	91
10.	9	0	80	108	92
Mean	9	4.8	86.90	109.70	97.30
Standard Deviation			6.19	4.05	5.22

TABLE 11

AGES AND INTELLIGENCE SCORES OF FEMALES
IN THE HIGH PERFORMANCE GROUP

Subject Number	Age yrs.	Age mos.	Verbal I.Q. Scores	Performance I.Q. Scores	Full Scale I.Q. Scores
1.	10	3	94	118	106
2.	10	0	82	101	91
3.	10	9	85	106	94
4.	10	7	85	114	99
5.	8	7	85	100	91
6.	10	0	85	101	92
7.	8	2	86	100	92
8.	10	0	79	104	90
9.	10	8	85	111	97
10.	8	0	97	113	105
Mean	9	8.4	86.30	106.80	95.70
Standard Deviation			5.04	6.34	5.56

TABLE 12

AGES AND INTELLIGENCE SCORES OF MALES
IN THE NO-DIFFERENCE GROUP

Subject Number	Age yrs.	Age mos.	Verbal I.Q. Scores	Performance I.Q. Scores	Full Scale I.Q. Scores
1.	9	9	92	93	92
2.	9	9	97	100	99
3.	8	2	104	107	106
4.	8	9	101	100	101
5.	10	8	97	97	97
6.	10	1	105	107	107
7.	9	1	108	104	107
8.	9	4	106	110	109
9.	9	11	96	97	96
10.	10	5	90	92	90
Mean	9	7.1	99.60	100.70	100.40
Standard Deviation			5.81	5.83	6.32

TABLE 13

AGES AND INTELLIGENCE SCORES OF FEMALES
IN THE NO-DIFFERENCE GROUP

Subject Number	Age yrs.	Age mos.	Verbal I.Q. Scores	Performance I.Q. Scores	Full Scale I.Q. Scores
1.	9	1	97	97	97
2.	9	2	103	101	102
3.	10	3	106	104	105
4.	8	8	110	106	109
5.	10	2	100	101	101
6.	8	1	100	103	101
7.	10	7	99	101	100
8.	9	1	100	99	99
9.	8	11	108	110	109
10.	9	1	97	99	98
Mean	9	3.7	102.00	102.10	102.10
Standard Deviation			4.34	3.62	4.04

APPENDIX D

ERRORS-TO-CRITERION, TRIALS-TO-CRITERION, PASSES-TO-CRITERION SCORES OF PARTICIPANTS

TABLE 14

SCORES FROM THE 16-PICTURE PAIRED-ASSOCIATES LEARNING TASK AS RECORDED FOR MALES IN THE HIGH VERBAL GROUP

Subject Number	Trials to Criterion	Errors to Criterion	Passes to Criterion
1.	6	40	56
2.	6	24	72
3.	9	49	95
4.	6	17	79
5.	6	37	59
6.	7	28	84
7.	14	94	130
8.	5	29	51
9.	9	41	103
10.	6	37	59
Mean	7.40	39.60	78.80
Standard Deviation	2.54	14.37	23.71

TABLE 15

SCORES FROM THE 16-PICTURE PAIRED-ASSOCIATES LEARNING TASK AS RECORDED FOR FEMALES IN THE HIGH VERBAL GROUP

Subject Number	Trials to Criterion	Errors to Criterion	Passes to Criterion
1.	6	35	61
2.	5	24	56
3.	6	36	60
4.	6	38	58
5.	7	52	60
6.	4	16	48
7.	7	52	60
8.	5	27	53
9.	10	57	103
10.	6	19	77
Mean	6.20	35.60	63.60
Standard Deviation	1.54	13.68	14.91

TABLE 16

SCORES FROM THE 16-PICTURE PAIRED-ASSOCIATES LEARNING TASK AS RECORDED FOR MALES IN THE HIGH PERFORMANCE GROUP

Subject Number	Trials to Criterion	Errors to Criterion	Passes to Criterion
1.	8	42	86
2.	7	41	71
3.	8	36	92
4.	8	56	128
5.	7	33	79
6.	5	29	51
7.	6	31	65
8.	12	64	128
9.	7	41	71
10.	9	64	80
Mean	7.70	52.30	85.10
Standard Deviation	1.79	15.06	23.99

TABLE 17

SCORES FROM THE 16-PICTURE PAIRED-ASSOCIATES LEARNING TASK AS RECORDED FOR FEMALES IN THE HIGH PERFORMANCE GROUP

Subject Number	Trials to Criterion	Errors to Criterion	Passes to Criterion
1.	9	64	80
2.	9	69	75
3.	6	24	72
4.	6	35	61
5.	7	47	65
6.	5	28	52
7.	9	54	90
8.	5	27	53
9.	8	46	82
10.	6	43	53
Mean	7.00	43.70	68.30
Standard Deviation	1.55	14.71	12.85

TABLE 18

SCORES FROM THE 16-PICTURE PAIRED-ASSOCIATES LEARNING TASK AS RECORDED FOR MALES IN THE NO-DIFFERENCE GROUP

Subject Number	Trials to Criterion	Errors to Criterion	Passes to Criterion
1.	4	20	44
2.	4	21	43
3.	7	53	59
4.	6	25	71
5.	10	61	99
6.	6	38	58
7.	9	68	76
8.	17	139	133
9.	4	22	42
10.	11	76	100
Mean	7.80	52.30	72.50
Standard Deviation	3.89	15.06	28.53

TABLE 19

SCORES FROM THE 16-PICTURE PAIRED-ASSOCIATES LEARNING TASK AS RECORDED FOR FEMALES IN THE NO-DIFFERENCE GROUP

Subject Number	Trials to Criterion	Errors to Criterion	Passes to Criterion
1.	8	50	78
2.	4	24	40
3.	7	46	66
4.	8	47	81
5.	7	33	79
6.	12	65	127
7.	9	48	96
8.	7	42	70
9.	6	37	59
10.	6	23	73
Mean	7.40	41.50	76.90
Standard Deviation	2.01	12.08	21.82