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A Comparison of the Wechsler Adult Intelligence Scale-Revised with the Peabody Picture Vocabulary Test-Revised

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1983

A COMPARISON OF THE WECHSLER ADULT INTELLIGENCE SCALE - REVISED WITH THE PEABODY PICTURE VOCABULARY TEST - REVISED

A Thesis

Presented to

the Faculty of the Department of Psychology

Western Kentucky University

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

by

Cynthia Lane Burris

August 1983

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A Comparison of the
Wechsler Adult Intelligence Scale - Revised
with the Peabody Picture Vocabulary Test - Revised

Recommended August 18, 1983
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A COMPARISON OF THE
WECHSLER ADULT INTELLIGENCE SCALE - REVISED
WITH THE PEABODY PICTURE VOCABULARY TEST - REVISED

Cynthia Lane Burris August, 1983 43 Pages

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The Peabody Picture Vocabulary Test (PPVT), a receptive vocabulary measure, and the Wechsler Adult Intelligence Scale (WAIS), a measure of general intelligence, have been two tests widely used by educators and psychologists, respectively. In addition to being used as a measure of receptive vocabulary, the PPVT was frequently used as a measure of intelligence. While the authors of the PPVT established IQ scores, this use of the PPVT frequently brought criticism from professional psychologists who felt that the test was not comprehensive enough to be used as a measure of general intelligence. The PPVT was revised in 1981, and the term "IQ" was no longer used as a descriptive term for the standardized scores. The authors clearly stated that the PPVT-R measured only one important facet of intelligence: receptive vocabulary. The revised version's age range expanded to 2½ through 40. The changes in the revision of the WAIS, also introduced in 1981, were not as significant as those of the PPVT-R. The WAIS-R was standardized for adults over the age of 16, so the PPVT-R and the WAIS-R share a larger age range (16-40) than did the original two versions (ages 16-18). The inclusion of adult norms on the PPVT-R make it possible to examine the relationship between receptive vocabulary (as measured by the PPVT-R)

and general intelligence (as measured by the WAIS-R) for adults of average intelligence. Through this study, sixty subjects between the ages of 16 and 33 were compared on these two instruments. Subjects were volunteers drawn primarily from a college population. Correlations, regression equations, and standard errors of estimate were obtained for the Total sample: Males, Females, Younger (CA 16-23), and older (CA 24-33). Data from age by sex cells (Younger Males, Older Males, Younger Females and Older Females) were also examined, but were interpreted cautiously due to the small sample size (N=15) in these cells. Results indicated that the PPVT-R (Form L) and WAIS-R (all three scales) have much commonality and significant correlations for all groups. There was one exception of a non-significant correlation with the Performance Scale for the Older group. The age by sex data revealed that the Older Female sub-group correlations between tests were not statistically significant. However, it was recognized that this sub-group was very restricted and probably not representative of females aged 24-33. Cautions regarding interpretation of the data are given. The lack of available information on comparison of these two frequently used tests leaves this area open for continued research.

CHAPTER I

Introduction

The Wechsler Adult Intelligence Scale (WAIS) has been one of the most popular and widely used scales of general intelligence for adults above the age of sixteen. The Peabody Picture Vocabulary Test (PPVT) was a receptive vocabulary test which was often used as a screening instrument or to provide an estimate of overall intelligence for school-aged populations and retarded adults (although it was normed for ages 2-18). The PPVT raw scores could be converted into intelligence quotients, and these IQ scores were often reported with little or no qualifying information. The use of the PPVT as an estimate of general intelligence for retarded individuals above the normed age range, along with the "overgeneralized" IQ scores, led to much professional criticism. Several studies were conducted to examine the relationships between the PPVT and the well respected measure of general intelligence, the WAIS.

The revised versions of these two frequently used tests were copyrighted in 1981. No research examining the relationships between the revised forms of these two tests has been reported to date. Anticipating the use of the PPVT-R (the revised version of the PPVT) as a screening instrument or to gain an estimate of IQ (as the original version was used)

leads to the need to examine the relationships between the PPVT-R and the WAIS-R (the revised version of the WAIS). It should be noted that Dunn and Dunn (1981) clearly state that the PPVT-R is not a measure of general intelligence, and its use as such would be a misuse of this test.

In addition to the possible misuse of the PPVT-R as a measure of general intelligence, there is another important reason for examining the relationships between the PPVT-R and the WAIS-R. The original PPVT was standardized for ages 2½ - 18, while the WAIS was only for ages above 16; therefore, there were only two years of the age range which the two tests shared, i.e. 16-18. No information is available regarding the relationship between receptive vocabulary (as measured by the PPVT-R) and general intelligence for normal adults over the age of 18. In this study these relationships will be examined.

The remaining portion of Chapter I will contain information regarding the original WAIS and the changes which make up the revision. Next, the changes between the PPVT and the PPVT-R will be examined. A review of the literature examining the relationships between the original versions of these two tests will be presented in Chapter II. In addition to a review of that literature, summaries will be provided of studies which have examined either the PPVT-R or the WAIS-R since information on either of these revisions might be helpful at this point, when little research has been published. Presented in Chapter III is a description of the design and methods

used for this study. The results and discussion of this study are presented in Chapter IV, and the summary is found in Chapter V.

As previously mentioned, the WAIS has been one of the most widely used scales of general intelligence. It was originally published in 1955. The WAIS included eleven subtests within two subscales, providing a Verbal Scale IQ and a Performance Scale IQ in addition to the Full Scale IQ. Items for the WAIS were selected based on their correlations with other established tests of intelligence, clinicians' ratings and empirical studies of several groups of known intellectual levels. At the time of the publication of the WAIS, Wechsler (1955) defined intelligence as being "multifaceted and multidetermined." He felt intelligence was an overall competency or global ability. The Wechsler scales of intelligence (ranging from a preschool scale to the adult scale) purport to measure these "major mental abilities." Wechsler's views "have not undergone any marked changes in recent years" (Wechsler, 1981, p. 7).

Continuing the attempt to measure various factors of intelligence, the eleven subtests and two subscales were retained in the WAIS-R. Both the WAIS and the WAIS-R require approximately 1 to 1½ hours administration time and both must be administered by a trained psychologist. The WAIS-R was normed for the same ages as the original WAIS (adults aged 16-74). The mean is 100 and the standard deviation is 15 for both the WAIS and the WAIS-R.

Although the WAIS-R does not deviate from the WAIS in regards to the concept of "intelligence" or the factors which comprise "intelligence," the revision did include several changes from the original WAIS. The order of administration of the subtests alternates the Verbal and Performance tests of the WAIS-R, whereas the original WAIS required administration of all Verbal tests, followed by all Performance tests. Items judged as being outdated on the WAIS were revised or dropped. The standardization of the WAIS-R was based on a stratified sampling plan based upon the 1970 United States Census and more recent population reports. The sample of 1880 individuals was stratified along the following variables: age, sex, race (white-nonwhite), geographic region, occupation, education, and urban-rural residence. The actual sample was very close to the "target" sample in all variables.

Only four years after the publication of the original WAIS, Dunn introduced the PPVT (1959). Two alternate forms were published (Form A and Form B). Although it was recognized as a measure of receptive vocabulary, it was also used as a measure of intelligence. The raw scores could be converted to "IQ" scores and "mental ages." Vocabulary items were selected by examining all entries in the 1953 edition of Webster's New Collegiate Dictionary whose meanings could be clearly illustrated by drawings. Repeated field testing and refinement led to the selection of the best 300 stimulus words and the construction of the plates for the PPVT. The PPVT was presented in a booklet form with one plate containing

four drawings which were exposed to the subject. The stimulus word was pronounced by the administrator, and the subject was asked to identify the picture which illustrated the stimulus word. It was standardized on an all white population in the Nashville, Tennessee area in the late 1950's.

The format and manner of presentation of the PPVT-R (again there are two alternate forms: Form L and Form M) is similar to that of the original PPVT. However, an easel form has replaced the booklet for ease of administration. Both the PPVT and the PPVT-R require approximately 20 minutes administration time and can be administered by anyone who takes the short time necessary to become familiar with the test materials. Both the original PPVT and the PPVT-R have a mean of 100 and a standard deviation of 15.

Despite the obvious similarities between the original PPVT and the PPVT-R, there are some significant modifications in the revision. The term "IQ" has been replaced with "Standard Score Equivalent" to describe the standardized scores. Similarly, the term "Mental Age" has been replaced with "Age Equivalent." Both of these changes were in an attempt to discriminate the PPVT-R from an intelligence test. Items have been updated and the drawings of the PPVT-R represent a better racial, ethnic and sex balance. The PPVT was standardized for ages 2½-18, whereas the PPVT-R has been standardized for ages 2½-40. The PPVT-R standardization was conducted on a national basis. The standardization sample for ages 2½-18 included 4200 children and youth stratified

along the following variables: age, sex, geographic region, occupation of the major wage earner of the family, ethnic origin, and community size. The "target" sample was based on data from the U.S. Census of 1970. Dunn and Dunn (1981) report that the standardization sample closely resembled the "target" sample for the 2½-18 age group. However, they reported some difficulty in obtaining a representative national sample of subjects aged 19-40. The final standardization sample included 828 adults which was balanced for age and sex of subjects, as well as occupational representation. Geographic representation was not as well balanced; the North Central and Western regions were over-represented, while the Northeastern and Southern regions were under-represented. No data were gathered on ethnic representation or community size representation for these adults.

It should be emphasized that two of the most significant changes in the PPVT-R as compared to the PPVT are the basis for this study. The first factor is the caution by Dunn and Dunn (1981) regarding the use of the PPVT-R as a measure of intelligence. They clearly state that the PPVT-R is designed to measure only one important facet of intelligence: receptive vocabulary. The second factor is that the PPVT-R is standardized for adults as well as ages 2½-18, thus making it possible to examine the relationship between receptive vocabulary (as measured by the PPVT-R) and general intelligence (as measured by the WAIS-R) for adults. This study is also relevant because of the limited research information available on the revisions of these two frequently used instruments.

This study will include examination of various statistical relationships between these two tests, including correlation of PPVT-R with WAIS-R Verbal Scale, Performance Scale and Full Scale; regression equation for predicting WAIS-R Verbal IQ, Performance IQ, and Full Scale IQ based on PPVT-R Standard Score Equivalent, and the corresponding standard errors of estimate.

Hypothesis

1) The correlation between the PPVT-R Standard Score Equivalent and the WAIS-R IQs will be highest with the Verbal Scale IQ, followed by Full Scale IQ, then by the Performance Scale IQ.

2) There will be no differences in the relationships of the two tests which are primarily due to the variables of age or sex.

CHAPTER II

Review of the Literature

This literature review is comprised of three sections. The first section presents a review of the published studies examining the relationships between the original PPVT and the original WAIS. The second and third sections, which examine published studies regarding the PPVT-R and the WAIS-R, respectively, are not as directly related to the issues of this thesis. However, it would seem that any information regarding tests which are so new and widely used might be of interest to the reader. A short summary of the literature review follows section three.

Studies Comparing the PPVT with the WAIS

No research has been published examining the relationships between the WAIS-R and the PPVT-R. The respective authors have suggested that research be applied until information on the revisions is available. Thus, this literature review will focus on research comparing the original WAIS and PPVT. To aid the reader in comparing the results of the various studies which have been published, summary tables are provided (see Table 1 and Table 2).

TABLE 1

Descriptive Data of Studies Comparing the PPVT with the WAIS

	N	Subjects	CA	PPVT		WAIS-V		WAIS-P		WAIS-FS	
				M	SD	M	SD	M	SD	M	SD
Tobias & Gorelick, 1961	107	MR adults	17-low 30's	66	12					60	10
Cochran & Pedrini, 1969	72	MR males	$\bar{x}$=21	64	14	63	10	64	13	61	11
Bonner & Belden, 1970	60	Normal Blacks	16-17	95						98	
Ernhart, 1970	118	Psychiatric In-Patients	$\bar{x}$=32	87	26					87	20
Pool & Brown, 1970	150	Psychiatric Outpatients		81	23					79	17[a]
Wells & Pedrini, 1971	92	MR Males	20-34	65	15	64	11	68	15	65	15
	58	MR Females	20-34	62	10	60	8	65	13	60	10
Covin & Covin, 1976	30	Normal	median age=199 mth.	76	16	81	16	77	14	78	15

[a]Short form of WAIS

Note. Portions of the data in Table 1 are from Clinical Interpretation of the Wechsler Adult Intelligence Scale (p. 32) by Zimmerman and Woo-Sam, 1973, New York: Grune & Stratton, Inc.

TABLE 2

Obtained Correlations and Regression Equations from Comparison Studies of the PPVT with the WAIS

	Correlations			Regression Equation for Full Scale	SE	
	W/V	W/P	W/FS		V	FS
Tobias & Gorelick, 1961	.66[a]*	.42[a]*	.61* .64[a]*			
Cochran & Pedrini, 1969	.60*	.69*	.72*			
Bonner & Belden, 1970	.67*	.35*	.58*	y = .42 x + 57.9		7.86
Ernhart, 1970	.88*	.75*	.86*			10.22
Pool & Brown, 1970			.81			
Wells & Pedrini, 1971						
Males	.71*	.65*	.74*	y = .63 x + 23.48	7.88	8.63
Females	.75*	.57*	.72*	y = .56 x + 25.68	5.60	6.94
Covin & Covin, 1976	.91*	.87*	.92*		approx. 7.0	

[a]based on PPVT raw score

*$p < .05$

Note. Portions of the data in Table 2 are from Clinical Interpretation of the Wechsler Adult Intelligence Scale (p. 32) by Zimmerman and Woo-Sam, 1973, New York: Grune & Stratton, Inc.

An examination of these tables indicates that the correlations found between the WAIS Full Scale IQ and the PPVT IQ range from .58 in the Bonner and Belden (1970) study, to .92, found by Covin and Covin (1976). All correlations were significant. In each study cited, with the exception of Cochran and Pedrin (1969), the PPVT correlated more highly with the Verbal Scale score or IQ than with either the Performance or the Full Scale of the WAIS; the correlation with the Performance Scale was the lowest in each of the studies cited, again with the Cochran and Pedrin (1969) exception. The PPVT mean IQ scores were higher than the WAIS mean IQ scores in most studies, with the only exceptions being the research by Bonner and Belden (1970) and Covin and Covin (1976), who found the WAIS scores to be higher, and Ernhart (1970), who found no significant difference between the mean IQs of the two tests. Various regression equations and standard errors of estimate have also been calculated (see Table 2).

A closer examination of these studies reveals serious limitations in the majority of them. Five of the seven studies reviewed were conducted with individuals of below average intelligence who were older than the normed ages for the PPVT. Only the Covin and Covin (1976) study mentioned any attempt to balance for sex and/or race of the subjects, but that study had a small total sample size, (N=30). As reported by Zimmerman and Woo-Sam (1973), Cochran and Pedrini (1969) controlled for sex variables limiting their study to males, and Bonner and Belden (1970) controlled for race

variables by limiting the study to Blacks. None of the reviewed studies mentioned counter-balancing order of administration of the tests or the possible confounding factor of the test administrator. Only three of the studies reported all of the descriptive data needed for comparisons between studies.

Summary of Current Research on the PPVT-R

Bracken and Prasse (1981) correlated PPVT, PPVT-R (Forms L and M) and placement IQ scores on 114 educable mentally retarded children. Forty-six subjects were white, 44 black, and 24 were Hispanic. The placement IQ instruments used included 65 Wechsler Intelligence Scales for Children - Revised, 39 Stanford-Binet's, 3 Wechsler Preschool and Primary Scales of Intelligence, and 4 McCarthy Scales of Children's Abilities. The PPVT and PPVT-R were significantly correlated for all three ethnic groups, but neither the original nor the PPVT-R correlated significantly with Total IQ as measured by the placement IQ tests. The mean PPVT-R standard scores were at least one standard deviation lower than the mean PPVT IQs. For the Total group, the mean PPVT-R score was 69.29, compared with the mean PPVT IQ of 53.58. The PPVT-R for these EMR students produced lower scores than either the original PPVT or the placement IQ instruments. The authors concluded that the low correlations between the PPVT-R and the placement tests, along with the significant mean differences, indicate that the PPVT-R is not a measure of intelligence, but rather a measure of receptive vocabulary.

As previously stated, this is a point which Dunn and Dunn (1981) clearly made in the manual of the PPVT-R.

Karnes, McCallum and Bracken (1982) compared the PPVT and PPVT-R as possible screening instruments for gifted students. The authors cited previous studies which have consistently shown that the PPVT-R produces lower standard score equivalents than the original PPVT IQ scores for normal preschoolers, "at risk" preschoolers, EMR school children and the trainable mentally retarded. For this study the subjects were 21 males and 15 females who had been identified as "gifted" either by an IQ of 120 or above on the Stanford-Binet or the Wechsler Intelligence Scale for Children - Revised, recommendation by an approved screening team, or current enrollment in an approved gifted program. As in previous studies, it was found that the PPVT-R Form L standard score equivalents were significantly lower than the PPVT IQs. The difference between Form L and Form M of the PPVT-R was not statistically significant. However, consistent with previous findings reviewed by Bracken, McCallum and Prasse which was cited by Karnes, McCallum and Bracken (1982), it was noted that only 49% of the variance in Forms L and M is shared variance. According to the authors, the review of six previous studies conducted by Bracken, McCallum and Prasse revealed a range from .65 to .89 in equivalent-form reliability coefficients. Karnes, McCallum and Bracken (1982) concluded that Forms L and M of the PPVT-R can safely be used interchangeably but the PPVT and the PPVT-R cannot.

Breen and Siewert (1983) conducted a study comparing the PPVT-R and the Wechsler Intelligence Scale for Children - Revised. Subjects were 59 students aged 6-15 years who had been referred for classroom learning problems. Thirty of the 59 were determined to be learning disabled; 22 of these were boys and 8 were girls with a mean age of 10 years, 5 months. The other 29 students who were referred consisted of 20 boys and 9 girls with a mean age of 10 years, 7 months. Correlations between the PPVT-R Form M and the WISC-R Verbal, Performance and Full Scale IQs were significant at the .05 level for both groups. The coefficients of determination (r^2) for both groups indicate a high degree of shared variance between the PPVT-R and the WISC-R Verbal Scale. The PPVT-R scores were significantly below the WISC-R IQ measures (on all 3 scales) for both groups, with differences of approximately 7-12 scaled score points. The authors concluded that although the PPVT-R and WISC-R Verbal Scale have much commonality, the two tests should not be treated as comparable measures of verbal intelligence. Breen and Siewert (1983) do state that the PPVT-R does "appear a most suitable screening instrument for verbal intelligence" (p. 98).

Summaries of Current Research on the WAIS-R

Naglieri (1982) computed confidence bands at the 85%, 90%, 95% and 99% levels for each of the nine standardization sample age groups and the entire sample of the WAIS-R. He reported Verbal-Performance differences which are required for the 90% and 99% levels of significance. This also was

computed for each age group and across the entire sample. A summary table of his findings, as presented by Naglieri (1982) is included in Appendix A.

Rabourn (1983) conducted a comparison study of the WAIS and the WAIS-R with 52 subjects chosen from the University of California Counseling Center intake. The median age was 22 and median level of education was grade 15. The WAIS and WAIS-R were administered concurrently by administering the WAIS, with the unique items of the WAIS-R inserted to 26 of the subjects. The other 26 subjects were given the WAIS-R with the unique items of the WAIS inserted. Results supported Wechsler's (1981) findings (with test - re-test methods) that the mean Full Scale IQs on the WAIS-R were lower than on the WAIS. In this study by Rabourn, the Full Scale mean IQ was 115.9 on the WAIS and 109.2 on the WAIS-R; corresponding standard deviations were 8.24 and 10.88. Rabourn suggests that clinicians be cautious in interpreting the WAIS-R in light of these differences between the WAIS and the WAIS-R. He states "to score within the average range of IQ on the WAIS-R predicates considerably more ability than would be required on the WAIS, especially if 109 represents the mean of a sample of people with a mean of 3 years of college education, most of whom are drawn from a highly competitive university population" (Rabourn, 1983, p. 361). Rabourn (1983) did find high correlations between the WAIS and the WAIS-R: Verbal (.96), Performance (.94), and Full Scale (.95).

Silverstein (1982) subjected the standardization data for the WAIS-R and the WAIS to factor analysis. This data included nine matrices, according to age groups for the standardization of the WAIS and WAIS-R. Two factors were suggested for all of the WAIS matrices and four of the nine WAIS-R matrices: Verbal Comprehension and Perceptual Organization. These two factors have long been associated with the Wechsler scales. The stability of these two factors was found to be very high. The average coefficient of congruence for the WAIS-R was .99 for Factor 1 and .98 for Factor 2. For the original WAIS the corresponding figures were .99+ for Factor 1 and .99 for Factor 2. Examination of the variance components of the subtests led the author to state that the Digit Span, Arithmetic, Picture Completion, Picture Arrangement, Block Design and Digit Symbol subtests of the WAIS-R could be interpreted specifically. According to Silverstein (1982), these subtests met Kaufman's (1975) criteria that the specific variance was greater than the error variance and accounted for at least ¼ of the total variance. On the original WAIS only the Arithmetic, Block Design and Digit Symbol subtests warrant specific interpretation according to Kaufman's (1975) guidelines.

Silverstein (1982) adds that according to another model of factor analysis, those subtests which do not warrant specific interpretation are the best measures of the general factor, "g" on intelligence. The results of this study indicated that 55% of the total variance and 94% of the

common variance of the WAIS-R is accounted for by "g." These values were even higher for the original WAIS, 60% and 97%, respectively. These figures would suggest that the scales measure a general factor only and interpretation should be limited accordingly, i.e., only the Full Scale IQ should be interpreted.

Naglieri and Kaufman (1982) also subjected the standardization data of the WAIS-R to factor analysis. They used six methods of factor analysis; methods I and II were based on principal components analysis, while methods III - VI all used principal factor analysis. The six methods yielded differing results. The number of factors produced ranged from 1 to 4. The 2 factors found included the familiar Verbal and Perceptual Organization factors. A third factor solution is another factor comprised of Digit Span, Arithmetic, and Digit Symbol, which closely resembles the Freedom from Distractibility Factor found on the WISC-R (Kaufman, 1979). In the analysis finding 4 factors, Picture Arrangement was the only subtest to load substantially on the 4th factor. The 4th factor was found to vary greatly between age groups and to be of very small magnitude. Due to these concerns, the 4th factor was not considered by Naglieri and Kaufman (1982) as they addressed the question of whether the WAIS-R is a 2 or 3 factor test battery. The authors answer this question by leaving it to the discretion of the clinician based on the examinee's subtest profile. The reader is referred to Kaufman's (1979) guidelines in determining when to interpret the third factor.

Another analysis of the factors underlying the WAIS-R was conducted by Parker (1983), who also used the nine age groups of the standardization sample for the WAIS-R. The two factor analyses yielded the expected factors of Verbal and Performance, with the subtests loading on each factor closely resembling the structure of the test and the subtest positions within each Scale. The Verbal Scale subtests loaded on the "Verbal" factor and the Performance Scale subtests on the "Performance" or "Perceptual Organization" factor. The only exceptions were the Arithmetic subtest, which is within the Verbal Scale yet loaded 4th highest on the Performance factor, and the Picture Arrangement subtest which, is on the Performance Scale yet loaded higher on the Verbal Scale in 7 of the 9 age groups. The 3 factor solutions produced the familiar loadings for Verbal Comprehension, Perceptual Organization and Freedom From Distractibility. Similar to the Naglieri and Kaufman (1982) study, Picture Arrangement and Picture Completion compiled the fourth factor.

Summary of Literature Review

This literature review was comprised of three sections. The first section summarized studies comparing the PPVT with the WAIS. It was noted that the reported correlations between these two tests ranged from .58 to .92. As would be expected, most studies found that the PPVT was most highly correlated with the WAIS Verbal Scale, followed by the Full Scale, and least correlated with the Performance Scale. The majority

of the studies cited found higher mean PPVT IQs than mean WAIS IQs. The two studies, with subjects of average intelligence who were of the age for which the two tests were normed, revealed higher mean WAIS IQs than PPVT IQs. Various regression equations and standard errors of estimate were also reported. Limitations in these studies were noted and made the results questionable.

The second section summarized the available information on the PPVT-R. The various studies reviewed in this section examined several aspects of the PPVT-R. Of possible significance to this particular thesis was the finding by Bracken and Prasse (1981) that their subjects (EMR students) scored lower on the PPVT-R than on the placement IQ tests. This finding is consistent with the two studies involving subjects of average intelligence and comparing the original PPVT with the WAIS. Another relevant point was made by Karnes, McCallum and Bracken (1982), who found no significant difference between Form L and Form M of the PPVT-R with their sample population of "gifted" students. Breen and Siewert (1983) found significant correlations between the PPVT-R and all three WISC-R Scales.

The third section reviewed the litarature available on the WAIS-R. Three studies examining the factors underlying the WAIS-R were summarized. The two and three factor analyses seem to be most widely accepted, which is not surprising since these are similar to the widely accepted factors of

The WISC-R. Of possible interest is Parker's (1983) findings that Arithmetic loads quite heavily on the Performance Factor, while Picture Arrangement loads more heavily on the Verbal Factor. Kaufman (1979) found similar results on the WISC-R.

CHAPTER III

Design and Methods

Subjects

Subjects were sixty volunteers aged 16-33, recruited by announcements in graduate and undergraduate college classes at Western Kentucky University, by notices posted on campus at W.K.U., and at a technical college and high school in Albermarle, North Carolina. Due to the recruitment techniques, most volunteers had some education beyond the 12th grade, ranging from one year of college through Master's level training. Most volunteers were native to the Southeastern region of the United States. All volunteers were Caucasion, with the exception of one Black male. It is recognized that using volunteers as subjects certainly is not as reliable as a random sample. One would suspect that volunteers recruited mostly from college populations might be of higher intelligence than the average population.

Design

Sixty volunteers aged 16-33 were matched and divided according to age and sex into four groupings. The WAIS-R and PPVT-R (Form L) were administered to each volunteer by this author. The order of administration of the two tests was counterbalanced with approximately one-half of each group receiving the PPVT-R first and one-half receiving the WAIS-R

first. The amount of time elapsing between administration of the two tests ranged from five minutes (taking the two tests in the same sitting) to three weeks. The PPVT-R was administered to two volunteers at the same time on four occasions by asking each volunteer to use a cover sheet and write his responses on an appropriately numbered sheet of paper. At these times the easel was positioned so that both volunteers could easily see the pictures. (Norris, Hottel and Brooks (1960) found no significant difference in test results of the PPVT when given individually and in groups.)

Description of Instruments

Dunn and Dunn (1981), in developing the PPVT-R, retained only 144 of the 300 stimulus words used on Forms A and B of the original PPVT. They increased the number of words on each form from 150 as in the original forms to 175 on Forms L and M of the PPVT-R. The new words were chosen from a scan of Webster's New Collegiate Dictionary and of published word lists for children and youth. The authors then used the Rasch-Wright Latent Trait Item Analysis to precisely calibrate each item for level of difficulty and to insure that the PPVT-R would be equally sensitive at all ages. The Rasch-Wright Latent Trait Item Analysis allowed the authors to select items to fit the rather precise "growth curve for hearing vocabulary - the latent trait being measured by the PPVT-R" (Dunn & Dunn, 1981, p. 33).

The mean of the PPVT-R is 100, with a standard deviation of 15. The median split-half reliability coefficient for the adult standardization sample was .82. The standard error of measurement at the 68% level of confidence across all age groups had a median of 7 Standard Score Equivalent points. From a sample of 1849 individuals aged 3 through 18 who were administered Form A of the PPVT and Form L of the PPVT-R in counter-balanced order, Dunn and Dunn (1981) report that the median PPVT-R standard score equivalent was 7 to 8 points lower than the median PPVT IQ. The authors report a range of correlations from .50 to .85 between the original PPVT IQ scores and the PPVT-R standard scores. Dunn and Dunn (1981) suggest that research findings for the PPVT be applied to the PPVT-R until data on the latter have been collected.

Unlike the PPVT-R which included many item changes from the original PPVT, Wechsler (1981) reported that about 80% of the items in the WAIS-R were from the original WAIS, either exactly as they appeared on the original test or with slight modifications. Items were selected based on their correlations with other established tests of intelligence, clinicians' ratings and empirical studies with several groups of known intellectual levels for the original WAIS. The WAIS-R eliminated dated items and some new items were added; Wechsler does not state how these new items were selected.

The mean of the WAIS-R is 100, with a standard deviation of 15, which is the same as the PPVT-R. Wechsler (1981)

reported that the split-half procedure yielded reliability coefficients of .97, .93, and .97 for the Verbal, Performance and Full Scale IQs,respectively. The average standard error of measurements across all ages for the three WAIS-R IQs at the 68% level of confidence are 2.74 IQ points for the Verbal Scale, 4.14 for Performance and 2.53 for the Full Scale IQ. A comparison of mean IQs of a sample of 72 cases at age 35-44 reveals that the WAIS-R IQs are about 7, 8, and 9 points lower than the WAIS IQs for the Verbal, Performance, and Full Scales,respectively. Correlations between the original WAIS and the WAIS-R for the same sample were .91 for Verbal IQ, .79 for Performance, and .88 for Full Scale IQ. As with the PPVT-R, the WAIS-R correlated highly enough with the original version to suggest the application of research findings for the original to the revised version until data on the WAIS-R have been collected.

Data Analysis

The Statistical Package for Social Sciences (SPSS) was used to obtain the regression equation for predicting WAIS-R Verbal Scale IQ, Performance Scale IQ and Full Scale IQ using the PPVT-R standard score equivalent as the predictor. These equations and the standard errors of estimate were computed for each of the following groups: all males, all females, subjects aged 16-23, subjects aged 24-33 and total sample. Correlations between the PPVT-R standard score equivalent and the WAIS-R Verbal IQ, Performance IQ and Full Scale IQ were also examined for each of the above mentioned groups.

CHAPTER IV

Results and Discussion

Various relationships between the WAIS-R and the PPVT-R (Form L) were examined for the Total sample, all Males, all Females, subjects aged 16-23, and subjects aged 24-33. Statistical Package for Social Science (SPSS) was used to obtain the correlation coefficients between the PPVT-R Standard Score Equivalent and the WAIS-R Verbal IQ, Performance IQ and Full Scale IQ for each of the above mentioned groups. Corresponding regression equations and standard errors of estimate for predicting WAIS-R IQs (Verbal, Performance and Full Scale) using the PPVT-R Standard Score Equivalent as the predictor were also reported.

Table 3 presents descriptive data regarding the sample groups. The mean IQs on the Verbal, Performance and Full Scales of the WAIS-R for the Total group were slightly greater than the theoretical mean of the WAIS-R (mean IQs ranged from 7-10 points greater than 100). The standard deviations on the three scales of the WAIS-R for the Total group ranged from 3-5 points less than the standard deviation of 15 on the WAIS-R. These data suggest that this sample was slightly more restricted and more intelligent than the standardization sample of the WAIS-R. The females in this sample were the most homogeneous group in relation to obtained scores on the

TABLE 3

Descriptive Data by Group

	N	WAIS-R VS $\bar{x}$	WAIS-R VS SD	WAIS-R PS $\bar{x}$	WAIS-R PS SD	WAIS-R FS $\bar{x}$	WAIS-R FS SD	PPVT-R(L) SS $\bar{x}$	PPVT-R(L) SS SD
Total	60	110.47	10.12	107.37	12.43	110.08	11.78	108.65	15.00
Males	30	110.63	12.12	107.10	14.36	110.30	14.45	106.37	15.49
Females	30	110.30	7.83	107.63	10.39	109.87	8.56	110.93	14.39
Younger CA 16-23	30	110.81	11.53	105.83	13.03	109.87	12.77	108.03	15.77
Older CA 24-33	30	110.07	8.66	108.90	11.81	110.30	10.91	109.27	14.44

WAIS-R, with standard deviations ranging from 5-7 points less than the WAIS-R standard deviation of 15. The Total group's mean Scale Score Equivalent on the PPVT-R (Form L) was approximately 9 points greater ($\bar{m}$=108.65) than the theoretical mean of 100. However, the standard deviation of the Total group sample is equal (SD=14.44) to that of the standardization of the PPVT-R. The mean PPVT-R Standard Score was 1.43 points lower than the mean WAIS-R Full Scale IQ for the total group. With the exception of the Female group, the mean PPVT-R Standard Score was lower than the WAIS-R Full Scale mean IQ for every group.

Table 4 presents descriptive data on the age by sex subgroups. It was found that the Older Female sub-group was the most restricted in relation to WAIS-R scores, with a lower mean standard deviation. This table also indicates that only the Older Females scored higher on the PPVT-R Standard Score than on the WAIS-R Full Scale IQ, causing a noted lower WAIS-R Full Scale score in the total Female group.

Table 5 presents the correlation coefficients and percentage of shared variance between the PPVT-R and the WAIS-R Verbal, Performance and Full Scales for each group of subjects. The PPVT-R is most highly correlated with the WAIS-R Verbal Scale, followed by the Full Scale, and least correlated with the WAIS-R Performance Scale. This order of decreasing correlation is found within each group. All correlations were significant ($p < .05$), with the exception of the correlation between the PPVT-R Standard Score and the WAIS-R

TABLE 4

Descriptive Data for Age by Sex Groups

	N	WAIS-R VS		WAIS-R PS		WAIS-R FS		PPVT-R(L) SS	
		$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
Younger Males CA 16-23	15	110.20	14.01	103.53	15.12	108.47	15.76	108.80	17.97
Older Males CA 24-33	15	111.07	10.37	110.67	13.08	112.13	13.30	103.93	12.70
Younger Females CA 16-23	15	111.53	8.85	108.13	10.58	111.27	9.24	107.27	13.82
Older Females CA 24-33	15	109.07	6.75	107.13	10.56	108.47	7.90	114.60	14.48

TABLE 5

Correlations and Shared Variance between PPVT-R and WAIS-R Scales by Group

	WAIS-R VS		WAIS-R PS		WAIS-R FS	
	r	r^2	r	r^2	r	r^2
Total	.67*	.45	.52*	.27	.65*	.42
Males	.78*	.60	.64*	.40	.76*	.57
Females	.54*	.30	.37*	.13	.54*	.29
Younger CA 16-23	.81*	.65	.68*	.46	.80*	.65
Older CA 24-33	.48*	.23	.34	.11	.46*	.21

*$p < .05$

Performance Scale IQ for the Older group. The correlations were of a lesser magnitude for the Older group as compared to the Younger, and for the Female group in comparison with the Male group.

In an attempt to explain these apparent age differences and sex differences, age by sex sub-groups were examined. Table 6 reveals that the correlations of the Older Females were lowest and non-significant on all comparisons. All correlations for the other three sub-groups were significant ($p<.05$). This finding indicates that this Older Female sub-group was responsible for the appearance of age and sex differences. The other comparisons did not show significant sex or age differences.

Tables 7 and 8 present the obtained regression equations and corresponding standard errors of estimate for the total group and sub-groups, respectively. Interpretation of the standard error of estimate must be considered in relation to the total variance within the WAIS-R scores; therefore, a direct comparison of standard errors of estimate cannot be made. For example, the standard error of estimate for each scale of the WAIS-R for the Females was less than that for the Males. However, it must be noted that the standard deviation for the females was also lower than that of the males, which accounts for the differences in the standard errors of estimate. It is important that the amount of shared variance between the two tests be examined. If the shared variance is not significant, it indicates that knowing

TABLE 6

Correlations and Shared Variance between PPVT-R and WAIS-R Scales for Age by Sex Sub-Groups

	WAIS-R VS		WAIS-R PS		WAIS-R FS	
	r	r^2	r	r^2	r	r^2
Younger Males CA 16-23	.80*	.64	.71*	.51	.79*	.62
Older Males CA 24-33	.79*	.62	.71*	.51	.81*	.65
Younger Females CA 16-23	.86*	.74	.67*	.44	.89*	.80
Older Females CA 24-33	.33	.11	.13	.18	.30	.09

*$p < .05$

TABLE 7

Regression Equations and Standard Errors of Estimate Group Using the PPVT-R as the Predictor of WAIS-R Scores

	Regression Equation	SE
WAIS-R VS		
Total	.45 P + 61.51	7.59
Males	.60 P + 45.97	7.77
Females	.29 P + 77.49	6.69
Younger	.59 P + 46.99	6.90
Older	.29 P + 78.71	7.74
WAIS-R PS		
Total	.43 P + 60.37	10.69
Males	.59 P + 44.17	11.25
Females	.26 P + 78.24	9.84
Younger	.56 P + 45.56	9.78
Older	.28 P + 78.82	11.32
WAIS-R FS		
Total	.51 P + 54.53	9.01
Males	.70 P + 35.32	9.63
Females	.32 P + 74.51	7.36
Younger	.65 P + 39.59	7.74
Older	.35 P + 72.52	9.87

TABLE 8

Regression Equations and Standard Errors of Estimate for Age by Sex Sub-Groups

	Regression Equation	SE
WAIS-R VS		
Younger Males	.62 P + 42.55	8.76
Older Males	.64 P + 44.34	6.66
Younger Females	.55 P + 52.63	4.72
Older Females	.15 P + 91.67	6.62
WAIS-R PS		
Younger Males	.60 P + 38.17	10.98
Older Males	.74 P + 34.24	9.51
Younger Females	.51 P + 53.54	8.20
Older Females	.98 P + 95.93	10.85
WAIS-F FS		
Younger Males	.69 P + 33.14	10.04
Older Males	.84 P + 24.31	8.15
Younger Females	.60 P + 47.30	4.34
Older Females	.16 P + 89.88	7.83

an individual's PPVT-R score will not aid in predicting his/her WAIS-R IQ; thus, the standard error of estimate becomes less meaningful.

Discussion

The sample for this study was slightly more restricted and more intelligent than the standardization sample of the WAIS-R. It was noted that the Older Female sub-group was the most homogeneous group in relation to WAIS-R scores, with standard deviations ranging from 5-8 points lower than the standardization sample for the WAIS-R. Also, the Older Female sub-group was the only sub-group to have a mean PPVT-R Standard Score which was higher than their mean WAIS-R Full Scale IQ. All other sub-groups were consistent with the two previous studies of "normal" samples in this respect. Bonner and Belden (1970) and Covin and Covin (1976) found mean PPVT IQs to be lower than the mean WAIS Full Scale IQs with the original versions of these two tests.

As predicted, considering that the PPVT-R is primarily a language-related test, the PPVT-R (Form L) was most highly correlated with the WAIS-R Verbal IQ, followed by the Full Scale, and least correlated with the WAIS-R Performance Scale IQ. This sequence of decreasing correlation was consistent within each group. An examination of age by sex cells revealed that the Older Females were the only sub-group to have correlations between the PPVT-R and WAIS-R (all three scales) which were not statistically significant.

The Older Females findings deviated from the findings of the other sub-groups and led to a closer examination of this group. At least eleven of the fifteen subjects in that cell were certified school teachers. This indication that the sample is not representative of all females aged 24-33 of average intelligence certainly limits inferences which can be drawn from the data. It is also recognized that this homogeneous sub-group was ¼ of the Total sample, which may suggest certain limitations on the inferences to be drawn from the groups, in general. However, the consistent finding of significant correlations between the PPVT-R and WAIS-R for all groups despite the impact of the Older Female group (which would depress the magnitude of the correlations found within those groups of which the Older Females were a part), suggests that the WAIS-R and the PPVT-R do have significant commonality.

With the recognized limitations of the Older Females sub-group sample, the results of this study indicate that receptive vocabulary (as measured by the PPVT-R) is highly correlated with overall intelligence (as measured by the WAIS-R) for adults of average intelligence. Knowing an individual's PPVT-R (Form L) Standard Score Equivalent can aid one in predicting one's WAIS-R IQ Scores on all three scales. Obtained regression equations and corresponding standard errors of estimate for such predictions are reported. However, the reliability of these data for those groups encompassing the Older Females (Older, Female and Total) may be

limited due to the recognized biased sample in that sub-group. These data should also be interpreted cautiously for the other sub-groups (Older Males, Younger Males, and Younger Females) due to the small sample size of these age by sex groups.

The PPVT-R Standard Scores tend to be slightly lower than either the WAIS-R Verbal or Full Scale score. This finding is also consistent with previous research on the PPVT-R.

CHAPTER V

Summary

The purpose of this study was to examine the correlation between the PPVT-R (Form L) Standard Score and the WAIS-R Verbal Scale, Performance Scale and Full Scale IQs. In addition, regression equations and standard errors of estimate were computed. The data were provided for each of the following groups: males, females, younger (aged 16-23) and older (aged 24-33), as well as the total sample. The data were also computed for the age by sex groups: younger males, older males, younger females, and older females. Cautions regarding the interpretation of this data for age by sex groups were given due to the small sample size in these groups.

As predicted, the PPVT-R (Form L) was most highly correlated with the WAIS-R Verbal Scale, followed by the Full Scale, and least correlated with the Performance Scale. This order of correlation was found in all groups and sub-groups. The results of this study indicate that the PPVT-R (Form L) and WAIS-R IQs (on all three scales) are significantly correlated for all groups, with the one exception of the correlation with the WAIS-R Performance Scale for the Older group. The correlations for the Older group as compared to the Younger group were of a lesser magnitude, as were the

Females' scores as compared to the Males' scores. These slight differences between the Younger and Older groups and between the Male and Female groups were not expected.

In an attempt to explain these noted differences in correlations, the age by sex cells were examined. It appeared that the Older Females was the sub-group where the correlations were weakest, contributing to lower correlations for the Older group and for the total Female group. None of the correlations for the Older Female sub-group were significant. It was recognized that this was a very homogeneous sub-group and that this lack of a representative sample could account for the noted differences between the age groups and between the sexes. It was suggested that predictions from Female data be made cautiously.

Regression equations and standard errors of estimate for predicting WAIS-R IQs based on PPVT-R (Form L) Standard Scores were calculated. Generally, the standard errors of estimate were lowest for the Females; however, this group also had lower standard deviations which could account for the lower standard error of estimate.

Overall, the results of this study suggest that the PPVT-R and WAIS-R have much commonality for most adults of average intelligence. According to these data, the tests have less shared variance for the Older Female group, but the reliability of these findings is limited due to the homogeneity of the sample. This sub-group's data also were included in the Female group, the Older group, and the Total sample,

depressing the obtained correlations for these groups. However, the correlations for these groups still were significant, with the previously noted exception of the Performance Scale for the Older group. This study supports Dunn and Dunn's (1981) premise that receptive vocabulary is highly correlated with general intelligence and may indeed be one of the major factors of general intelligence. According to this study, receptive vocabulary may account for as much as 42% of the variability in overall intelligence for adults of average intelligence.

The relationships between the PPVT-R and the WAIS-R for adults of below average intelligence need to be examined, as these tests will probably be used with these individuals frequently. These data could be examined in relation to the earlier studies cited in this thesis comparing the original WAIS and PPVT with this population of retarded adults. This approach might be especially revealing since the original PPVT was not standardized for use with individuals over the age of 18.

The lack of similar research examining the relationships between the revised versions of these two widely used tests provides an open area for substantial research. It is suspected that as the two tests, the PPVT-R and the WAIS-R, are increasingly used with adult populations, new research questions will arise and will need to be addressed.

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APPENDIX

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Appendix A

Table 1
Confidence Intervals for WAIS-R Verbal, Performance, and Full Scale IQ Scores

Age group (in years)	Scale	Level of confidence: 85% (p = .15)	90% (p = .10)	95% (p = .05)	99% (p = .01)
16–17	Verbal	5	5	7	9
	Performance	7	9	10	13
	Full Scale	4	5	6	8
18–19	Verbal	4	5	6	7
	Performance	7	8	9	12
	Full Scale	4	5	6	8
20–24	Verbal	4	5	6	8
	Performance	6	7	8	11
	Full Scale	4	4	5	7
25–34	Verbal	4	4	5	7
	Performance	5	6	8	10
	Full Scale	3	4	4	6
35–44	Verbal	4	4	5	7
	Performance	5	6	7	10
	Full Scale	3	4	4	6
45–54	Verbal	4	4	5	7
	Performance	5	6	7	10
	Full Scale	4	4	5	7
55–64	Verbal	4	4	5	6
	Performance	5	6	8	10
	Full Scale	4	4	5	7
65–69	Verbal	4	4	5	7
	Performance	5	6	7	10
	Full Scale	3	4	4	6
70–74	Verbal	4	4	5	6
	Performance	6	7	8	10
	Full Scale	4	4	5	6
All ages	Verbal	4	5	5	7
	Performance	6	7	8	11
	Full Scale	4	4	5	7

Table 2
WAIS-R Differences Between Verbal and Performance IQ Scores Required for Significance

Age group (in years)	Level of significance: 90% (p = .10)	99% (p = .01)
16–17	10	16
18–19	9	14
20–24	8	13
25–34	8	12
35–44	8	12
45–54	7	12
55–64	8	12
65–69	8	12
70–74	8	12
All ages	8	13

Note. The values necessary for significance at the .15 and .05 levels are presented in the WAIS-R *Manual* (Wechsler, 1981, p. 35).

From: Naglieri, J. (1982). Two Types of Tables for use with the WAIS-R. Journal of Consulting & Clinical Psychology 50(2), 320.