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The Relative Efficiency of Traditional WISC-R IQ's and WISC-R Factor Scores in Predicting Academic Achievement

Elizabeth Tulou

THE RELATIVE EFFICIENCY OF TRADITIONAL WISC-R IQ'S AND WISC-R FACTOR SCORES IN PREDICTING ACADEMIC ACHIEVEMENT

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Elizabeth Ann Tulou

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THE RELATIVE EFFICIENCY OF TRADITIONAL

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SCORES IN PREDICTING ACADEMIC ACHIEVEMENT

Recommended 8/1/75

David A. Shiel
Director of Thesis

Richard L. Mills

Harry R. Rolen

Approved August 29 1975

Elmer Gray
Dean of the Graduate College

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THE RELATIVE EFFICIENCY OF TRADITIONAL WISC-R IQ'S AND WISC-R FACTOR SCORES IN PREDICTING ACADEMIC ACHIEVEMENT

Elizabeth Ann Tulou August, 1975 40 pages

Directed by: D. A. Shiek, H. R. Robe, and R. L. Miller

Department of Psychology Western Kentucky University

The purpose of this study was to determine the relative predictive efficiency of the WISC-R deviation IQ's and the WISC-R factor scores in predicting academic achievement. Eighty-nine lower-middle to lower class fifth grade students were administered the WISC-R and the Stanford Achievement Test. WISC-R IQ's and WISC-R complete estimation factor scores were calculated for each student. Pearson Product Moment Correlations were calculated between the SAT stanines and the WISC-R IQ's, and, between the SAT stanines and the WISC-R factor scores. Of all of the predictor variables, the Verbal IQ was the most efficient. The results also indicated that two of the WISC-R factor variables, Verbal Comprehension and Freedom from Distractibility, were generally as efficient predictors as the Verbal IQ for math, spelling, reading, and total achievement. The Perceptual Organization factor variable did not prove to be as efficient as the Verbal IQ as a predictor of academic achievement.

The relative predictive efficiency of the variables was determined by rank-ordering the validity coefficiencies from highest to lowest within each achievement area. The highest validity coefficient was used

as a reference point from which the magnitude of the difference between it and the remaining coefficients was estimated. In general, the results yielded preliminary evidence that the WISC-R IQ's were as efficient predictors of academic achievement as the WISC-R factor structure. For example, the Freedom from Distractibility variable has demonstrated promise as a nonintellective aspect of intelligence and achievement, and coupled with the Verbal IQ, could be used in a short form of the WISC-R for predicting academic achievement.

Chapter I

Introduction

In the early 1930's, David Wechsler began to study existent intelligence tests. The outcome of his research was the development of the Wechsler-Bellvue Intelligence Scale using the point-scale format. Wechsler extracted and incorporated tasks from the Army Alpha, the Stanford-Binet Intelligence Test, the Healy Picture Completion Test, the Army Group Examinations, the Kohs Block Design, and the Army-Beta. The Wechsler-Bellvue, which was the precursor to the Wechsler Adult Intelligence Scale (WAIS), the Wechsler Intelligence Scale for Children (WISC), the Wechsler Preschool and Primary Scale of Intelligence (WPPSI), and recently the Wechsler Intelligence Scale for Children - Revised (WISC-R), directly reflected an assorted collection of age-related behaviors.

The rationale supporting the need for the various tasks is reflected in Wechsler's definition of intelligence. He saw intelligence as a global characteristic that is multifaceted and multidetermined. The selected tasks were organized into 11 subtests intended to reflect the total effectiveness of the individual "to measure one's overall capacity to understand and to cope with the world around him"

(Wechsler, 1974, p. 5). In addition, no one subtest was seen as more important than any other, or more reflective of one's intelligence. Wechsler's intent was to present numerous neutral but slightly structured items that would assure good integration and balance of such ego functions as planning, judgment, attention, concentration, memory, concept-formation, and visual-motor performance, as well as such nonintellective factors as sensitivity to social, moral, and ethical issues, resistance, control, and awareness (Sattler, 1974).

The final organization of the Wechsler scales consisted of five to six verbal and five to six nonverbal subtests. These scales yielded Verbal Scale, Performance Scale, and Full Scale deviation IQ's. Wechsler justified the Verbal-Performance dichotomy in the following manner:

> The grouping of the subtests into Verbal and Performance, while intending to emphasize a dichotomy as regards possible types of ability called for by the individual tests, does not imply that these are the only abilities involved in the tests. Nor does it presume that there are different kinds of intelligence, e.g. verbal, manipulative, etc. It merely implies that there are different ways in which intelligence may manifest itself. The subtests are different measures of different kinds of intelligence, and the dichotomy into Verbal and Performance areas is only one of several ways in which the tests could be grouped. (Wechsler, 1958, p. 64)

Consistent with Wechsler's position, his scales have been utilized to assess many aspects of human behavior. Watson (1963) noted that intelligence scales, such as those developed by Wechsler, measure more than just an individual's current level of intellectual

functioning.

> Performance on the Wechsler-Bellvue Intelligence Scale, like other measures in this area of functioning, is not only a means of appraising the intellectual level of an individual, but also a method of studying many other facets of behavior. The performance sampled by the Wechsler-Bellvue is an expression not of intelligence alone, but of the personality as a whole. (Watson, 1963, p. 179)

The uses of the Wechsler scales have been varied and many alternative methods for evaluation and interpretation have been demonstrated. Besides assessment of intelligence, the Wechsler scales have been used for other clinical and diagnostic purposes. Studies involving persons with specific psychopathologies have shown that particular scatter patterns can be detected from the Wechsler scales for schizophrenia, sociopathic behavior, organic brain diseases, anxiety, mental deficiency, depressive conditions, acting out behavior, neuroses, psychoses, and some personality disorders (Ogdon, 1967; Watson, 1963; Wechsler, 1958). In addition to predicting certain psychopathologies, the Wechsler scales have also been used as a measure of academic aptitude to determine the effects of environmental deprivation, and as an estimate of prognosis in therapy (Ogdon, 1967).

In the late 1950's research on the WAIS and the WISC turned from descriptive and predictive studies using the traditional Wechsler format and organization to factorial studies that attempted to identify what structural factors could be isolated from these instruments.

John Cohen (1959) factor analyzed the WISC 1949 standardization sample for the chronological age groups of 7-6, 10-6, and 13-6. His results indicated that there were five primary factors involved in each of the age groups: Factor A - Verbal Comprehension I; Factor B - Perceptual Organization; Factor C - Freedom from Distractibility; Factor D - Verbal Comprehension II; and Factor E - Quasispecific, for which no psychological interpretation was made.

Other factor analysis studies were also conducted on the WISC. Silverstein (1969), for example, reanalyzed the same data that Cohen had used in 1959 and found that only two meaningful factors existed. Osborne (1966), Osborne, Anderson, and Bashaw (1967), and Osborne and Lindsey (1967) also identified reliable factors in the WISC. As many as eight to 12 factors were isolated depending upon the nature of the variables in the matrix and the method used for factor identification.

Kaufman (1975) utilized the WISC-R 1974 standardization sample and identified three major factors: Verbal Comprehension, Freedom from Distractibility, and Perceptual Organization. He addressed himself to the following issues: (1) to factor analyze the WISC-R at each age level between 6-6 and 16-6; (2) to examine the existence of any developmental trends in the WISC-R factor structure across all age levels; and (3) to make the results interpretable for clinical applications. To determine the factor structure, Kaufman used a

varimax rotation and discovered that the three factor solution was the most appropriate for nine of the 11 age groups. The type of factor analysis procedure was not seen as critical since the three factors were also present with other types of rotations. He found that Verbal Comprehension consisted of the Vocabulary, Information, Comprehension, and Similarities subtests; that the Picture Completion, Picture Arrangement, Block Design, Object Assembly, and Mazes subtests made up Perceptual Organization; and that Freedom from Distractibility included the Arithmetic, Digit Span, and Coding subtests. Because of the closeness with which the Verbal Comprehension and the Perceptual Organization factors resembled the Verbal and Performance Scales, Kaufman felt that his study gave strong empirical support for the Verbal-Performance dichotomy. Freedom from Distractibility proved to be a nonintellective factor which added a new dimension to the scope of the scale not included in the traditional organization.

Miller (1975) conducted a structural, cross-validation study of the WISC-R and reported the same basis factor structure to be present in his sample. Verbal Comprehension was primarily composed of Information, Similarities, Vocabulary, and Comprehension. Perceptual Organization included Picture Completion, Picture Arrangement, Block Design, Object Assembly, and Mazes. Freedom from Distractibility was composed of Arithmetic, Digit Span,

and Coding. Miller's sample consisted of 126 fifth grade students from two elementary schools located in a municipality in Southcentral Kentucky. The subjects came from predominantly lower- to lower-middle class socioeconomic backgrounds. Most of the subjects were white with a mean age of 10 years, 7 months.

Generally, research on the factor structure of the WISC by Cohen (1959), Osborne et al. (1967), Osborne and Lindsey (1967), and Silverstein (1969), resulted in considerable disagreement as to the number of factors present. The WISC-R has been shown to be more stable in regard to the number of identified factors. Kaufman (1975) and Miller (1975) found three factors of similar composition lending support to the factorial simplicity and consistency of the WISC-R.

As the Wechsler scales factor structure has become more stable, methods for determining and interpreting factor scores have been suggested. Two slightly different methods have been proposed by Kaufman and Cohen for calculating factor scores. Cohen suggested computing the average scaled scores for the subtests associated with each factor as one possibility. Kaufman, on the other hand, suggested using the Verbal IQ and the Performance IQ as factor scores for the Verbal Comprehension and Perceptual Organization factors, respectively. He proposed estimating the Freedom from Distractibility score by averaging the scaled scores associated with that factor.

The major limitation, when either of these two methods is employed, is that neither method has utilized the relationships between all subtests and the factor structure. These methods may have a minimizing effect on the variance and independence within and between factor scores. If all factor score coefficients, weighted by their magnitude and sign, were included in calculating the factor scores, maximal variance would be obtained and maximal independence would be assured. It was for these reasons that a more complete estimation approach for determining the factor scores was developed. Such a method more accurately reflects the relationships that exist within the factor structure.

As has been advocated by many researchers, it would seem logical that reorganization of the WISC-R into factors could be useful for predictive purposes with the possibility of expanding the current uses of this scale. It may be that a more effective or appropriate technique for evaluating an individual's intellectual abilities would be possible through the use of complete estimation factor scores. The proposed factor scores could provide an alternative approach for interpreting the WISC-R results by means of reorganizing, to some degree, the subtests into more meaningful structural groups. This, in turn, could increase the usefulness of the WISC-R by expanding the number of predictor variables associated with the scale as well as increasing its predictive ability.

Chapter 2

Review of the Literature

In the past, the Wechsler scales have been used to predict various criteria such as psychotic and neurotic disorders, mental deficiency, personality disorders, and abnormal life styles (Ogdon, 1967; Watson, 1963; Wechsler, 1958). During childhood and adolescence, the prediction of academic achievement has been one of the more common uses of the Wechsler scales, particularly the WISC. Numerous studies have used the traditional WISC IQ's as predictors of academic achievement. As a result of the diversity in the types of samples and the uniqueness of the methods used across studies utilizing the WISC as a predictor of academic achievement, the presentation of this literature has been organized chronologically. To date, no studies have attempted to explore the efficiency of WISC factor structure variables in predicting academic achievement.

Correlate studies investigating the relationships between academic achievement and the WISC was begun in 1951 by Frandersen and Higginson. One of the purposes of this study was to investigate the degree to which the WISC predicted academic achievement as measured by the Stanford Achievement Test (SAT). Of the various predictors used in this study, they found that the WISC was the best

predictor of academic achievement. The validity coefficient between the WISC and the SAT was .76.

Mussen, Dean, and Rosenberg (1952) followed with a study that indicated that the WISC Performance, Verbal, and Full Scale IQ's were more accurate predictors of academic achievement than any other frequently used intelligence scales. Various estimates of achievement were used and the subjects were composed of elementary school-aged children from Ohio State University. The validity coefficients between the WISC and the achievement criterion ranged from .29 to .81.

In 1956, Richardson and Surko explored the relationships between the WISC and measures of academic achievement for 105 juvenile delinquents from the state of New Jersey. Each child was given the WISC, Gray's Standardized Oral Reading Paragraphs, and the Stanford Achievement Test, Form D, which yielded scores in reading and arithmetic. The Gray Reading was compared to the WISC Full Scale, the WISC Verbal, the WISC Vocabulary, and the WISC Coding. The coefficients for these correlations were .58, .59, .55, and .40, respectively. The WISC Full Scale was compared to the Stanford Reading and Arithmetic with r's of .59 and .64, respectively. The Stanford Arithmetic and the WISC Arithmetic correlated at .46. These findings demonstrated that the WISC had moderately strong predictive ability with an atypical child sample.

The following year, Stroud, Blommers, and Lauber (1957) conducted a study using 725 students from grades three through six to determine the degree to which all, or various combinations, of the WISC subtests best predicted Reading Comprehension, Arithmetic, and Spelling from the Iowa Test of Basic Skills Battery (ITBS). The pupils in this sample were not randomly selected from the general population in that they were referred by teachers and/or school officials for psychological interviews because of some kind of school difficulty. Most of the students were at least one year retarded in the three academic achievement areas. Validity coefficients were calculated between the WISC Verbal, Performance, and Full Scale IQ's and each achievement test. Reading correlated with the Full Scale IQ, Verbal IQ, and Performance IQ with r's of .66, .58, and .63, respectively. For the Arithmetic achievement test, the correlations were found to be .66 for the Full Scale, .67 for the Verbal Scale, and .52 for the Performance Scale. Spelling correlated with the Wechsler IQ's with r's of .67 for the Full Scale IQ, .63 for the Verbal IQ, and .60 for the Performance IQ. For the most part, the Full Scale IQ correlated with the ITBS variables to a higher degree than any of the other measures of intelligence.

Mayer (1958) investigated the predictive validity of the WISC in relation to teacher assigned class grades and the Sequential Tests of Educational Progress (STEP). He used 271 seventh grade students

from a junior high school in Newark, Delaware and found that the WISC Full Scale IQ correlated with the STEP Reading at .62 which suggested a moderate but substantial relationship. In relation to class grades, Mayer found that the WISC correlated moderately high with a predictive validity coefficient of .73. These results tended to support prior findings in that the WISC was a usable predictor of academic achievement.

In an attempt to investigate the validity of the WISC in predicting school achievement in bilingual children, Cooper (1958) selected three groups of bilingual children and administered several individual tests of intelligence, including the WISC, to each group. Most of the tests correlated from moderately high to high with the California Achievement Test, Form AA, Elementary Level (CAT). The WISC and the total CAT score yielded a correlation coefficient of .77.

In 1960, Kimbrel compared the WISC IQ measures, obtained from 62 institutionalized retardates, to an academic criterion. These subjects were selected on the basis of their ability to score within the WISC norms and not below. The achievement criterion was the Gray-Votaw-Rogers Achievement Test. The WISC and the grade placement criterion yielded an r of .40. Considering the restrictions of variance due to the sample, the results supported the WISC as an efficient predictor of academic achievement.

An extensive study was done by Egeland, DiNello, and Carr (1970) to determine the predictive validity of various academic aptitude

measures with boys in the first and third grades. These boys were given a battery of tests which included the WISC. In addition, the 82 students were given the Metropolitan Achievement Test as a criterion measure. The correlation coefficients between the WISC Full Scale IQ and four areas of achievement - Word Knowledge, Word Discrimination, Reading, and Spelling - proved significant at p .05. Predictive validity coefficients for the WISC for the first grade group on Word Knowledge was .25, for Word Discrimination .25, for Reading .20, and for Spelling, .30. For the third grade, the validity coefficients were .26 for Word Knowledge, .38 for Word Discrimination, .35 for Reading, and .43 for Spelling. Generally, the results of this study yielded lower validity coefficients than previous studies.

Sundean and Salopeck (1971) attempted to determine the degree to which the Wide Range Achievement Test (WRAT) scores of 192 children in primary and elementary classes for the educable mentally retarded correlated with the WISC IQ's. Specifically, one of the hypotheses tested was that there was no difference between the WISC Verbal IQ and the WISC Performance IQ as predictors of WRAT performance in reading, spelling, and arithmetic. This hypothesis was accepted. When corrected for restricted variance, the study yielded coefficients between the WISC Verbal IQ's and the WRAT scores for the primary group in reading, spelling, and arithmetic of .89, .86, and .89, respectively. The corrected coefficients for the

Performance IQ's and the WRAT for the elementary level were .87, .86, and .89, respectively.

One of the many uses of the WISC has been to predict academic achievement. On the whole, the traditional WISC variables have proven to be efficient predictors of academic achievement for normal and handicapped children. The typical validity coefficients from the studies conducted using the WISC as a predictor of academic achievement fell in the range of .55 to .65. Educational skills such as reading, math, and spelling have been the primary achievement criteria utilized. The WISC has also been demonstrated to be an adequate predictor of grade placement and school grades. To date, no research was available using the WISC-R as a predictor of achievement. It was assumed, but not empirically demonstrated, that the WISC-R, in its traditional format, had similar predictive qualities as the WISC. This assumption has been made on the basis that the intent of the revision of the WISC was not to alter the constructs measured, structure, or organization of the instrument, but to update and improve the test (Wechsler, 1974). To date, no research was available establishing the predictive validity of the WISC or the WISC-R factor scores. It was, therefore, the purpose of this study to determine not only the predictive ability of both the traditional WISC-R IQ's and the WISC-R factor scores regarding academic achievement, but also to determine the relative efficiency of both methods.

Chapter 3

Method

The sample was composed of fifth grade students from four classroom units from two elementary schools located in a municipality of approximately 50,000 in Western Southcentral Kentucky. The sample included 89 students that were drawn from an original group of 126 subjects. Thirty-seven of the original sample were excluded due to incomplete criterion data. The mean age of the students was 10 years, 6 months, and for the most part they came from lower- to lower-middle socioeconomic backgrounds. There were 45 males and 44 females in the sample. Included within this group were 69 whites and 20 blacks.

The WISC-R was used in this study for the purposes of predicting academic achievement. Each student was individually administered the WISC-R by a graduate student in clinical psychology in a university training clinic in the fall of 1974. Testing for the WISC-R was conducted in individual testing booths in the clinic facility. Standardized procedures were followed for all administrations and scoring in accordance to the WISC-R Manual (Wechsler, 1974). Verbal, Performance, and Full Scale deviation IQ's and factor scores were calculated for each subject.

The methods for determining factor scores proposed by Cohen (1959) and Kaufman (1975) were not utilized in this study because these methods might have had the effect of minimizing the variance and independence of the factor scores.

> It has been customary to build factor scales employing only those variables that have substantial loadings on a given factor. It seems, however, that the complete estimation method. . .has some advantages over such shorthand methods. In the shorter method, the influence of the variables not included in the scale construction is not controlled; they will affect the scale through their intercorrelations with the variables used in the scale. In the complete estimation method, on the other hand, some variables are simply used as suppression variables to give the best estimate of the given factor. (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975, p. 488)

From this point of view, and in an attempt to maximize the variance and independence of the factors, the complete estimation approach was used.

The intercorrelation matrix from the WISC-R 10-6 year standardization sample was used as the basis for computing the factor score coefficients. The Statistical Package for the Social Sciences (SPSS), Subroutine Factor, Option 7 (Nie et al., 1975), was used to obtain the factor score coefficients as presented in Table 1. The factor scores for the Verbal Comprehension, Perceptual Organization, and Freedom from Distractibility factors were determined by multiplying each factor score coefficient by the appropriate WISC-R

TABLE 1

Factor Score Coefficients Based on the WISC-R

10-6 Standardization Sample Factor Structure

Subtest	Verbal Comprehension	Perceptual Organization	Freedom from Distractibility
Information	0.21170	-0.08987	0.07194
Similarities	0.30127	-0.05891	0.05511
Arithmetic	0.06331	-0.07452	0.23525
Vocabulary	0.44250	-0.09656	-0.06282
Comprehension	0.20030	-0.01936	-0.09291
Digit Span	-0.09695	-0.09973	0.47245
Picture Completion	0.04992	0.26349	-0.22650
Picture Arrangement	-0.00571	0.10790	0.02187
Block Design	-0.30539	0.63109	0.18466
Object Assembly	0.00410	0.17545	-0.08904
Coding	-0.04080	-0.00589	0.18602
Mazes	-0.03840	0.10189	0.03548

scaled score. The products were summed to yield factor scores for all three factors.

The Stanford Achievement Test, Intermediate Level 2, Form A, 1973 Edition (SAT) was utilized as the criterion measure. It was a group administered achievement test which measured the specific academic skills: Reading Vocabulary, Reading Comprehension, Word Study Skills, Spelling, Math Concepts, and Math Applications. In addition, the summary variables, Total Reading, Total Math, and Total Battery, were also employed. The SAT was group administered across the four classroom units in two elementary schools in April of 1975. The homeroom teachers administered the test according to standardized procedure. Machine scoring was done by Harcourt, Brace, Jovanovich Corporation and the results were reported in stanine standard score units.

Pearson Product Moment Correlations were performed via the SPSS program, subprogram PEARSON CORR (Nie et al., 1975) between the SAT stanine scores and the WISC-R Verbal, Performance, and Full Scale IQ's, and between the SAT stanine scores and the three WISC-R factor scores. The correlations were rank-ordered within achievement areas and the magnitude of the difference between the highest validity coefficient and the remaining correlations was determined by *t*-tests for coefficients from non-independent samples (Ferguson, 1966). These values were considered significant at the $p < .01$ level for a one-tailed test of significance.

Chapter 4

Results

The means and the standard deviations for the traditional WISC-R IQ's, the WISC-R factor scores, and the SAT stanine scores are summarized in Table 2. The WISC-R mean IQ's fell below the standardization mean of 100 although well within the average range of intelligence. The achievement measures reflected similar findings with all mean scores falling in the low average range of academic achievement. No national standardization parameter was available for factor scores comparisions. Even though the group was slightly below average in their performances, very little restriction of variance appeared present. All of the standard deviations, with the exception of the factor scores for which there were no national norms, approximated national distributions. The standard deviation of 15 for the WISC-R standardization sample was closely reflected in the obtained values of 15.1 for the Verbal IQ, 12.5 for the Performance IQ, and 13.2 for the Full Scale IQ. The SAT results also approximated national norms by approaching the stanine standard deviation of 2.0.

The Pearson Product Moment Correlations between the stanine scores and the WISC-R IQ's, the SAT stanine scores and the WISC-R factor scores, and the significance levels from a zero correlation are

TABLE 2

Predictor and Criterion Descriptive Statistics

Variable	Mean	Standard Deviation
WISC-R Deviation IQ's		
Verbal	92.27	15.14
Performance	97.02	12.50
Full Scale	93.81	13.20
WISC-R Factor Scores		
Verbal Comprehension	6.78	2.81
Perceptual Organization	7.95	2.49
Freedom from Distractibility	6.46	2.08
SAT Stanine Scores		
Vocabulary	4.36	1.69
Reading Comprehension	4.25	1.73
Word Study Skills	4.58	1.79
Math Concepts	4.35	1.96
Math Computation	4.25	1.85
Math Applications	4.00	1.68
Spelling	4.39	1.68
Total Reading	4.29	1.69
Total Math	4.09	1.95
Total Battery	4.10	1.75

presented in Table 3. All of the predictor variables, with the exception of Perceptual Organization, yielded validity coefficients significant at the $p < .01$ level.

When the validity coefficients were rank-ordered, and the magnitude of the difference between the highest coefficient and all other coefficients were calculated, it was possible to determine the relative efficiency with which these variables predicted academic achievement. As Table 4 illustrates, the traditional Verbal IQ was the best single predictor for the SAT Reading criteria with validity coefficients ranging from .61 to .69. Since the Verbal IQ variable had the highest validity coefficients, it was used as a reference from which the efficiency of the other predictor variables were judged. Generally, the Verbal Comprehension factor scores, the Full Scale IQ's, and the Freedom from Distractibility scores all yielded lower but significantly similar validity coefficients to the Verbal IQ. An exception occurred in the prediction of the Reading Vocabulary measure where the Freedom from Distractibility predictor yielded a significantly lower validity coefficient. The Performance IQ and the Perceptual Organization validity coefficients were significantly lower than the Verbal IQ coefficient at the .01 level for all of the reading achievement skills.

Table 5 is composed of the rank-ordered validity coefficients for the math achievement criteria. As with the reading criteria, the

TABLE 3

WISC-R Traditional IQ and Factor Score Validity Coefficients

SAT Test	VIQ	PIQ	FSIQ	VC	PO	FD
Vocabulary	.6133 (.001)	.3199 (.001)	.5584 (.001)	.5787 (.001)	.0922 (.1951	.3560 (.001)
Reading Comprehension	.6329 (.001)	.3114 (.001)	.5694 (.001)	.5705 (.001)	.0105 (.4613	.3123 (.001)
Word Study Skills	.6568 (.001)	.2629 (.006)	.5684 (.001)	.5847 (.001)	.0735 (.2479	.3042 (.001)
Total Reading	.6933 (.001)	.3289 (.001)	.6223 (.001)	.6058 (.001)	.0783 (.2339	.3633 (.001)
Math Concepts	.6490 (.001)	.3926 (.001)	.6245 (.001)	.5423 (.001)	.1501 (.0801	.4309 (.001)
Math Computations	.5142 (.001)	.2852 (.003)	.4840 (.001)	.4453 (.001)	.0439 (.3413	.4552 (.001)
Math Applications	.6172 (.001)	.3634 (.001)	.5801 (.001)	.5513 (.001)	.1253 (.1211	.4403 (.001)
Total Math	.6102 (.001)	.3498 (.001)	.5741 (.001)	.5242 (.001)	.1006 (.1741	.4880 (.001)
Spelling	.5673 (.001)	.2379 (.012)	.4827 (.001)	.5076 (.001)	-.0537 (.3081	.4791 (.001)
Total Battery	.6932 (.001)	.3435 (.001)	.6250 (.001)	.6167 (.001)	.0635 (.2771	.5224 (.001)

Note. The following abbreviations for the criteria are used: VIQ = Verbal IQ, PIQ = Performance IQ, FSIQ = Full Scale IQ, VC = Verbal Comprehension, PO = Perceptual Organization, and FD = Freedom from Distractibility. Numbers in parentheses indicate significance levels from a zero correlation.

TABLE 4

Rank Ordered Validity Coefficients:

Reading Skills

SAT Test	Predictor					
	VIQ	VC	FSIQ	FD	PIQ	PO
Vocabulary	.61	.58(.50)	.56(.50)	.36(.01)	.32(.01)	.09(.01)
	VIQ	VC	FSIQ	FD	PIQ	PO
Reading Comprehension	.63	.57(.10)	.57(.10)	.51(.10)	.31(.01)	.01(.01)
	VIQ	VC	FSIQ	FD	PIQ	PO
Word Study Skills	.66	.59(.50)	.57(.50)	.50(.05)	.26(.01)	.07(.01)
	VIQ	VC	FSIQ	FD	PIQ	PO
Total Reading	.69	.62(.50)	.62(.50)	.56(.05)	.33(.01)	.08(.01)

Note. Numbers in parentheses indicate significance levels from highest validity coefficients. The following abbreviations for the criteria are used: VIQ = Verbal Intelligence Quotient, PIQ = Performance Intelligence Quotient, FSIQ = Full Scale Intelligence Quotient, VC = Verbal Comprehension, PO = Perceptual Organization, and FD = Freedom from Distractibility.

TABLE 5

Rank Ordered Validity Coefficients:

Arithmetic Skills

SAT Test	Predictor					
Math Concepts	VIQ	FSIQ	VC	FD	PIQ	PO
	.65	.62(.50)	.54(.50)	.49(.05)	.39(.01)	.15(.01)
Math Computations	VIQ	FSIQ	VC	FD	PIQ	PO
	.51	.48(.50)	.46(.50)	.45(.10)	.29(.01)	.04(.01)
Math Applications	VIQ	FSIQ	VC	FD	PIQ	PO
	.62	.58(.50)	.55(.05)	.44(.02)	.36(.01)	.13(.01)
Total Math	VIQ	FSIQ	VC	FD	PIQ	PO
	.61	.57(.50)	.49(.10)	.49(.10)	.35(.01)	.10(.01)

Note. Numbers in parentheses indicate significance levels from highest validity coefficients. The following abbreviations for the criteria are used: VIQ = Verbal Intelligence Quotient, PIQ = Performance Intelligence Quotient, FSIQ = Full Scale Intelligence Quotient, VC = Verbal Comprehension, PO = Perceptual Organization, and FD = Freedom from Distractibility.

Verbal IQ's proved to be the best predictors of math achievement for the Math Concepts, Math Applications, and Total Math variables. Since it had the highest validity coefficients, the Verbal IQ was used as the reference to evaluate the predictive efficiency of the remaining variables. The Full Scale IQ's, the Verbal Comprehension variable, and the Freedom from Distractibility variable all had predictive validity coefficients which were statistically similar to the Verbal IQ coefficients. The Performance IQ and the Perceptual Organization variable coefficients were significantly lower than the Verbal IQ coefficient.

In relation to Spelling achievement, it was found that the Verbal IQ was the best single predictor (see Table 6). The Verbal Comprehension variable, the Full Scale IQ, and the Freedom from Distractibility variable yielded validity coefficients equivalent to the Verbal IQ. Once again the Performance IQ and the Perceptual Organization factor yielded validity coefficients that were statistically lower than the Verbal IQ at the .01 level of significance.

For the Total Battery, the Verbal IQ once again proved to be the best predictor of academic achievement (see Table 7). No significant differences were obtained between the Verbal IQ validity coefficient and the coefficients associated with the Full Scale IQ and the Verbal Comprehension variable. The Freedom from Distractibility variable, the Performance IQ, and the Perceptual Organization

TABLE 6

Rank Ordered Validity Coefficients

Spelling

SAT Test	Predictor					
	VIQ	VC	FSIQ	FD	PIQ	PO
Spelling	.57	.51(.50)	.48(.50)	.48(.50)	.24(.01)	-.05(.01)

Note. Numbers in parentheses indicate significance levels from the highest validity coefficient. The following abbreviations from the criteria are used: VIQ = Verbal Intelligence Quotient, PIQ = Performance Intelligence Quotient, FSIQ = Full Scale Intelligence Quotient, VC = Verbal Comprehension, PO = Perceptual Organization, and FD = Freedom from Distractibility.

TABLE 7

Rank Ordered Validity Coefficients:

Total Battery

SAT Test	Predictor					
	VIQ	FSIQ	VC	FD	PIQ	PO
Total Battery	.69	.63(.05)	.62(.02)	.52(.01)	.34(.01)	.06(.01)

Note. Numbers in parentheses indicate significance levels from the highest validity coefficient. The following abbreviations for the criteria are used: VIQ = Verbal Intelligence Quotient, PIQ = Performance Intelligence Quotient, FSIQ = Full Scale Intelligence Quotient, VC = Verbal Comprehension, PO = Perceptual Organization, and FD = Freedom from Distractibility.

variable all yielded predictive coefficients which were significantly lower than the Verbal IQ coefficient at the .01 level.

Chapter 5

Discussion

The results of this study provided preliminary evidence to support that the WISC-R was as efficient a predictor of academic achievement as the WISC for generally normal subjects. For the most part, the factor variables were efficient predictors of academic achievement but they were no more efficient than the WISC-R IQ's. There was no evidence to support the substitution of the factor scores for the traditional IQ's with these types of criteria.

It was shown that of all of the predictor variables, the Verbal IQ was the best single predictor of academic achievement. It was consistently ranked as having the highest validity coefficient across all achievement areas, and for this reason, it was used throughout the study as the reference point from which the magnitude of the differences between it and the remaining coefficients was calculated. The full Scale IQ was found to be lower but as efficient as the Verbal IQ in predicting academic achievement ranking as the second or third highest validity coefficient. The Performance IQ, however, did not prove to be as efficient as the Verbal IQ and ranked as one of the lowest validity coefficients.

The factor variables, with the exception of Perceptual Organization, were found to be as efficient predictors as the Verbal IQ. The Verbal Comprehension validity coefficients appeared nearly equivalent to the Full Scale IQ coefficients, ranking second or third to the Verbal IQ for all areas of achievement. The Freedom from Distractibility variable was also as efficient as the Verbal IQ with the exception of predicting Reading Vocabulary and Total Battery. The Perceptual Organization variable was consistent with the Performance IQ in that it failed to be statistically as efficient as the Verbal IQ in predicting academic achievement.

Several conclusions could be drawn from these findings. First, since a national standardization sample was not available to transform the factor scores into normalized standard scores, the effects of specific sampling idiosyncracies could have lowered the values of the factor score coefficients. This in turn would have erroneously represented the values of the factor scores distorting their actual ability to predict academic achievement. It was felt that in order to achieve the ultimate utilization of the factor scores in the prediction of academic achievement, research needs to be conducted in which the WISC-R standardization sample is employed for the purpose of standardizing the factor scores. Until the raw score values can be converted into standard scores units, from which interpretable data can be drawn across all age levels, their absolute value will remain meaningless.

Another outcome of this study was support for Kaufman's conclusions that the Verbal IQ and the Verbal Comprehension factor, and the Performance IQ and the Perceptual Organization factor, were for the most part interchangeable. The results indicated that the Verbal IQ and the Verbal Comprehension variables were equivalent in their predictive efficiency and that the same was true for the Performance IQ and the Perceptual Organization factor.

A third outcome of the study was the role played by the Freedom from Distractibility factor, which was the least intellective of all of the predictor variables and the least influenced by formal education. As has been stated, it was, with two exceptions, as efficient a predictor of achievement as the Verbal IQ, and yet is composed of those subtests of the WISC-R which have been least understood in regard to their actual function in determining individual intelligence (Kaufman, 1975; Miller, 1975). This seems to give support to Wechsler's belief that intelligence is composed of more than just intellective factors and that intelligence is a function of the total personality.

From a diagnostic point of view, this nonintellective dimension of the WISC-R could be extremely useful. It may be possible, with further research, to develop an abbreviated version of the WISC-R that would include only those subtests associated with the Verbal IQ and the Freedom from Distractibility factor and which would accurately and economically predict achievement. This combination of the Verbal IQ

and the Freedom from Distractibility factors would include both intellective and nonintellective constructs.

Clinically, a short form would be especially helpful in attempting to isolate those factors involved in school-related adjustment problems. It has been shown that some school-related problems have relatively little to do with an individual child's academic aptitude and that the problem frequently lies within his nonintellective capacities to cope. The use of the Freedom from Distractibility scale may help to identify those children with organic and emotionally based attending disorders who need some type of adaptation in class structure, presentation of learning materials, or even interpersonal relationships between teacher and child, or, between the child and his peers. From a preventive point of view, those children who come from a high probability referral population, such as the one used in this study, and who have low Freedom from Distractibility scores, could be screened out to reduce future school-related stress by giving them the appropriate attention.

The results of this study support the concept that there is potential for expanding the usefulness of the WISC-R through the use of the factor structure. With other samples and other criteria, the factor structure may prove to be extremely useful as an additional interpretive frame of reference. The Freedom from Distractibility factor may add a new dimension to the WISC-R in not only the prediction

of academic achievement, but evaluating general intelligence. It may be that new characteristics in atypical behavior patterns such as those discussed by Watson (1963) and Ogdon (1967) may be found via factor score research. The Freedom from Distractibility factor, for example, may prove to be an essential variable in diagnosing specific learning disabilities, organic brain disease, and mental deficiency.

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