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# WISC-R performance patterns of referred Anglo, Hispanic, and American Indian children

Snyder, Barbara Jean, Ph.D.

The University of Arizona, 1991

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# WISC-R PERFORMANCE PATTERNS OF REFERRED ANGLO, HISPANIC, AND AMERICAN INDIAN CHILDREN

by

Barbara Jean Snyder

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A Dissertation Submitted to the Faculty of the

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THE UNIVERSITY OF ARIZONA

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As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Barbara Jean Snyder

entitled WISC-R Performance Patterns of Referred Anglo, Hispanic, and American Indian Children

and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

Shitala Mishra — Date: 11-15-91

Lawrence Aleamoni — Date: 11/15/91

John Obrzut — Date: 11-15-91

Date

Date

Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

Dissertation Director
Shitala Mishra — Date: 11-15-91

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SIGNED: Barbara J. Snyder

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ABSTRACT

The purpose of this study was to investigate the performance patterns of Anglo, Hispanic, and American Indian children on the WISC-R. The WISC-R is the most commonly used measure of ability for students who are referred for psychoeducational evaluation to determine special education placement. For this study, the WISC-R was administered to 48 American Indian children from various tribes, 64 Hispanic children, and 64 Anglo children who attended an urban school in a large Southwestern city. The subjects of the study, who were in 1st through 8th grades, were referred for evaluation based on their academic difficulties or were being reevaluated to determine the necessity for continued placement in learning disability programs.

An examination of mean differences between the Verbal and Performance scores of the three groups revealed that differences between the Verbal and Performance scores were smallest for Anglo subjects. The Hispanic and American Indian groups each had a difference of one standard deviation between their Verbal and Performance scores.

An exploratory factor analysis resulted in differing factor structures for each group. The Anglo children demonstrated the three factor structure defined by Kaufman (1975). The principal axis factoring extracted four factors

for the Hispanic group. Three factors were extracted for the American Indian subjects; however, Factor 1 and Factor 2 differed from those of the Anglo subjects. Factor 3 was similar to that of the Anglo subjects.

A confirmatory factor analysis was used to evaluate the equivalency of a hypothesized factor structure and Kaufman's (1975) three-factor structure among the three groups. The hypothesized model was found to fit across the three groups. The best fit for this model was between the Anglo and American Indian subjects. The poorest fit was between the American Indian and Hispanic students. No fit between the Anglo and Hispanic students was found for Kaufman's three-factor model.

Implications of these results and recommendations for future research examining the assessment of children from minority cultures are discussed.

# CHAPTER 1

## INTRODUCTION

Three critical areas of concern center around the appropriateness and usefulness of current measures of general intellectual functioning: fairness to minorities, appropriate educational placement decisions, and educational interventions (Reschly & Wilson, 1990). Allegations of standardized test bias and minority overrepresentation in special education programs have been the crux of an intense debate, often resulting in very expensive and divisive litigation. Reynolds (1982) identified six frequently cited objections to the utilization of educational and psychological tests with minority children.

(1) Test content, typically based on white, middle-class experiences and values, may be inappropriate for many minority children due to lack of exposure to the mainstream culture and differential life experiences.

(2) Standardization samples may be inappropriate because ethnic minorities are either underrepresented or not represented at all.

(3) Examiner and language bias may result due to cultural and language differences between the examiner and

the examinee, inadvertently resulting in intimidation and, consequently, lowered test scores.

(4) Inequitable social consequences result when bias in educational and psychological testing compounds an existing problems of disadvantages in the vocational and educational markets.

(5) These tests may be measuring different constructs for minority children from those purported, for example, they may measure familiarity with white culture (Mercer & Lewis, 1979).

(6) Differential predictive validity results when tests accurately predict academic performance for white children but not minority children.

The validity for minority children of traditional IQ tests such as the Wechsler Intelligence Scale for Children-Revised (WISC-R) (Wechsler, 1974), which is the most frequently used psychoeducational evaluation instrument for school-aged children (Reschly, Genshaft, & Bender, 1987), has been questioned. According to 1970 Census data, the WISC-R standardization sample included Anglos, Blacks, American Indians, and Asians. Hispanics were categorized by the examiner as white or nonwhite according to their physical characteristics (Wechsler, 1974). Several court cases have challenged the validity of special education placement decisions for minority children based on

WISC-R results Diana, 1970; Guadalupe, 1972; Larry P., 1979). The effects of these legal decisions include the requirement of test administration in the child's primary language, banning intelligence testing for placement decisions in California without a court review, and the declaration by a judge that certain test items are biased. Clearly, educational psychologists must investigate the validity issues of the WISC-R as they relate to minority children.

WISC-R research with Hispanic and American Indian children has probed validity issues and external factors affecting test performance. Validity concerns include Verbal and Performance Scale score discrepancies, differing factor structures, item bias, and reliability and predictability. External factors affecting test performance include sociocultural, neurological, and physiological factors and their potential for differential impact on test results (McShane, 1980).

The intent of this study was to investigate factor-structure issues impacting the interpretation of WISC-R results for Hispanic and American Indian children who have been referred for a psychoeducational evaluation based on academic difficulties they were experiencing. A review of validity issues included Verbal-Performance Scale score discrepancies and underlying WISC-R factor structures.

The subjects for this research were drawn from a small elementary school district within a large metropolitan area in the Southwest. Many Hispanic and American Indian families migrate to large metropolitan areas due to inadequate employment opportunities in their respective homeland or reservation. When American Indian and Hispanic children attend schools where white, middle-class values proliferate, cultural differences may precipitate a misunderstanding of learning and cognitive styles since the dominant culture dictates perceptions of the environment, problem solving methods, and the assimilation of new information.

## Importance of the Study

Research examining the administration and interpretation of the WISC-R with American Indian children is scarce. This study addresses concerns that psychologists and educators in metropolitan areas may have. Specifically, this study was designed to benefit psychologists in the district from which the sample was drawn.

The results provide a more appropriate interpretation of the WISC-R for minority children, which should result in greater understanding of learning styles and the use of more effective teaching techniques. Informed interpretation is intended to mitigate areas of concern, unfair minority assessment practices, inappropriate educational placements,

and ineffective educational interventions, as well as add information to the current body of literature.

# CHAPTER 2

# LITERATURE REVIEW

The current study examined scoring patterns of Anglo, Hispanic, and American Indian children on the Wechsler Intelligence Scale for Children-Revised (Wechsler, 1974). The purpose of this chapter is to review the literature related to the administration of the WISC-R with Hispanic and American Indian children. Verbal-Performance discrepancy patterns, content validity, construct validity, Bannatyne's (1974) recategorized WISC-R scores, information processing, predictive validity, variables affecting test performance, and a summary are included.

## Verbal-Performance Discrepancy Patterns

As shown in Table 1, researchers of WISC-R test performance of American Indian and Hispanic children have reported substantial discrepancies between WISC-R Verbal and Performance Scale scores, posing internal consistency and validity questions. A study of limited-English-proficiency (LEP) Hispanic children in south Texas revealed Verbal-Performance discrepancies of 21 points (Fourquean, 1987). Palmer, Olivarez, Willson, and Fordyce (1989) reported Verbal-Performance mean differences of 12-13 points for non-LEP students referred for testing and Table 1

Table 1

Mean Difference of WISC-R Verbal and Performance Scales

| Researcher(s) | Subjects | N | VIQ | PIQ | V-P |
|---|---|---|---|---|---|
| Naglieri & Yazzie (1983) | Navajo not referred | 37 PLN | 75 | 104 | 29 |
| Teeter, Moore, & Peterson (1982) | Navajo referred | 189 ED | 60 | 94 | 34 |
| | | 150 LD | 58 | 7 | 29 |
| | | 113 NH | 66 | 96 | 30 |
| | 6-8 yr.: | 58 ED | 59 | 94 | 35 |
| | | 61 LD | 59 | 86 | 27 |
| | | 35 NH | 65 | 97 | 32 |
| Hynd, Quackenbush, Kramer, Conner, & Weed (1979) | Navajo Reservation School | 44 PLN | 64 | 95 | 31 |
| McShane (1980) | Ojibwa & Sioux Gifted, Urban | 17 | 98 | 110 | 12 |
| | 7th-12th gr. | 18 | 77 | 88 | 11 |
| | 6-16 yr. | 33 | 80 | 94 | 14 |
| | K-6th | 21 | 79 | 91 | 12 |
| McShane & Plas (1984a) | Ojibwa Reservation School | 35 | 91 | 104 | 14 |
| Browne (1984) | Northern Plains | 197 | 78 | 105 | 27 |
| Mishra (1984) | Tonono O'odham | 46 | 81 | 88 | 7 |
| Connelly (1983) | Tlingit 6-10 yr. | 61 | 83 | 93 | 10 |
| | 11-16 yr. | 84 | 76 | 94 | 18 |

Table 1--Continued

| Researcher | Subjects | N | VIQ | PIQ | V-P |
|---|---|---|---|---|---|
| Forquean (1987) | Hispanic LD, LEP | 42 | 68 | 89 | 21 |
| Palmer et al. (1989) | Hispanic LEP, ref | 22 | 71 | 91 | 20 |
| | LEP, nonref | 24 | 73 | 95 | 22 |
| | non LEP, ref | 34 | 86 | 97 | 11 |
| | non LEP, nonref | 41 | 93 | 106 | 13 |

ref = Referred Group
nonref = Nonreferred Group
LD = Learning Disabled
LEP = Limited English Proficiency
ED = Educationally Disadvantaged
NH = Non Handicapped
PLN = Primary Language Navajo

non-referred urban Hispanic children. LEP referred Hispanic children had mean differences of 19 points, and LEP non-referred children had mean differences of 22 points. In a literature review of referred Navajo children, Teeter, Moore, and Peterson (1982) found Verbal-Performance discrepancies ranging from 27 to 35 points. The authors reached five conclusions.

1. The Performance Scale is the least biased measure of potential for these children because lower Verbal scores reflect divergent language, cultural, and experiential factors rather than an intellectual deficit.
2. Tasks requiring attention and concentration were less difficult for these Navajo children than tasks requiring a high level of English proficiency.
3. The Verbal IQ score may be useful as an index of academic proficiency in English-speaking classrooms, especially for reading comprehension tasks.
4. The Full Scale IQ score was biased by the effect of language and should not have been reported as an overall index of functioning.
5. Children who demonstrated visual processing deficits scored lower than their counterparts on

the Performance Scale subtests; therefore, the WISC-R was not a good measure of their true potential.

These findings concur with the results of Hynd et al. (1979), thus supporting the generalizability of this study to other primary-grade Navajo children. Fourquean (1987) concluded that the Performance Scale is a more appropriate measure of intelligence, while the Verbal Scale may measure acquired verbal abilities or may be used as a short-term predictor of academic achievement for bilingual children.

McShane (1980) attributed depressed Verbal scores in his study of American Indian children to poor English language skills; difficulty evoking verbal responses based on their tendency to be shy, reticent, and non-verbal; and average to slightly superior perceptual skills, which accounted for scoring well on the Performance Scale.

## Content Validity

Item bias threatens content validity when a test item varies in difficulty for members of different groups. Mishra (1982) found item bias in 15 (19%) of the 79 items in the Information, Similarities, and Vocabulary subtests; however, he advocated consideration of three possible limitations of the study. First, specific sources of item bias cannot be inferred from the findings because the results only indicate that performance on certain verbal

items was not homogeneous across groups. Second, generalizability is limited to Navajos from lower socioeconomic groups who live in isolated areas of the Navajo Nation and have limited intercultural interaction. Finally, results cannot be generalized to other American Indian tribes or to more acculturated Navajos. While these limitations should be examined, they do not negate the value of the results.

Item analysis of the scores on the six Verbal subtests by Ross-Reynolds and Reschly (1983) revealed item bias in 33% of the items in a sample from the Tohono O'odham tribe. The rank order of item difficulty for this group differed from that of the standardization group. The criterion for the discontinuation of subtests may have precluded the administration of many items identified as biased. Items 7 and 13 on the Information subtest and Item 6 on the Arithmetic subtest were clearly biased. Ross-Reynolds and Reschly emphasized that decisions concerning item bias should be based on empirical results rather than on subjective judgment. For example, the item "Who discovered America?," with a keyed response of Columbus, appears to be biased, especially when administered to a Native American child. However, this item was not statistically biased. The authors stress that criteria other than standardized tests must be used to assess individuals.

The only commonality between the Navajo (Mishra, 1982) and Tohono O'odham (Ross-Reynolds & Reschly, 1983) studies was the inclusion of the Information, Similarities, and Vocabulary subtests (see Table 2). Analysis techniques, sample size, and populations differed. Future research should investigate patterns of item bias across American Indian groups, as well as between acculturated children and those from traditional Native American environments.

## Construct Validity

Construct validity is threatened when a test measures different hypothetical traits for divergent groups or measures the same trait with contrasting results. Kaufman (1975) factor analyzed the WISC-R standardization sample using principal-components analysis followed by varimax rotation of factors with eigenvalues greater than 1 to provide a guide to the most appropriate number of factors. Next, a principal-factor analysis with squared multiple correlations in the diagonal as final estimates of communalities was conducted at each age level. This was followed by varimax rotation of 2-, 3-, 4-, and 5- factor solutions. Kaufman and Silverstein (1977) each identified three stable factors (Factor 1, Verbal Comprehension; Factor 2, Perceptual Organization; and Factor 3, Freedom from Distractibility) for the normative group utilizing factor analytic techniques with slightly different rotation

Table 2

Item Bias

| Researcher(s) | Subjects | N | Subtests | Biased Item Numbers |
|---|---|---|---|---|
| Ross-Reynolds & Reschley (1983) | O'dham 6.3-15.9 years | 238 | Info | 7*,13*,15-24 |
| | | | Sim | 10-14 |
| | | | Arith | 6*,13,14,17 |
| | | | Voc | 15-19,22,24,27 |
| | | | Comp | 10-14,16,17 |
| Mishra (1982) | Navajo low SES with limited intercultural interaction | 40 | Info | 12,15,16,17,19 |
| | | | Sim | 10,11,13,14 |
| | | | Voc | 9,16,17,18,19, 20 |
| Combined Results of the Above Studies | Navajo & O'dham | 278 | Info | 15,16,17,19 |
| | | | Sim | 10,11,13,14 |
| | | | Voc | 16,17,18,19 |

* = Clearly biased

methods. Verbal Comprehension can be interpreted to represent verbal reasoning, and Perceptual Organization can be interpreted to represent nonverbal reasoning. The Freedom from Distractibility factor is typically interpreted to represent attention (Kaufman, 1975). These three factors were utilized in numerous subsequent studies, several of which are discussed in the remainder of this section.

In a statified random sample of Anglo, Hispanic, Black, and Tohono O'odham subjects, Reschly (1978) found the three-factor analysis for the Anglo and Hispanic children identical to that of the normative group. The third factor was uninterpretable for the Black and Tohono O'odham subjects; however, two-factor solutions representing the Verbal Comprehension and Perceptual Organization factors were identical for all four groups. Validity of the Freedom from Distractibility factor was questionable for minorities in the sample.

Zarske, Moore, and Peterson (1981) analyzed two- and three-factor solutions for learning-disabled Navajo and Tohono O'odham children. Kaufman's (1975) Freedom from Distractibility factor was not apparent for either group, supporting Reschly's (1978) findings. Zarske et al. concluded that the WISC-R is a reliable index of general intelligence for both groups and that the WISC-R does

measure verbal and performance abilities in learning-disabled Navajo and Tohono O'odham groups.

Gutkin and Reynolds (1980) compared two- and three-factor solutions across referred Anglo and Hispanic children who were primarily from lower-middle-class backgrounds. When the principal-factor analyses were conducted, only two factors emerged for both groups. A three-factor solution was extracted by overriding the normal eigenvalue criteria; however, the second and third factors were difficult to interpret because the performance subtests were split between them. The two- and three-factor factor solutions were congruent across groups. Gutkin and Reynolds concluded that the validity of the Freedom from Distractibility factor was questionable, although the Verbal Comprehension factor and the Perceptual Organization factor were supported across a variety of ethnic groups for referred and nonreferred populations.

Rousey (1990) compared factor structures for the Spanish version of the WISC-R (WISC-RM) administered to children from Baja, California, Mexico, and the English version administered to Hispanic and Anglo children from California. The principal components analysis retained three principal components using the eigenvalue criterion of one. All performance subtests and no Verbal subtests loaded substantially on the first factor. Four of the six verbal

subtests loaded on the verbal factor, and no Performance subtests had their highest loading on this factor. Digit Span, Mazes, Arithmetic, and Comprehension subtests loaded substantially on the third factor, Freedom from Distractibility. Rousey concluded that the factorial invariance among these three groups indicated that the WISC-R and WISC-RM were measuring the same dimensions in the three groups.

As shown in Table 3, results of three studies of American Indian and Hispanic children were not consistent. Consequently, concluding that the WISC-R has sufficient construct validity for American Indian and Hispanic children may be inappropriate. WISC-R Verbal scores may represent factors such as acculturation to Anglo society or English language proficiency.

### Bannatyne's Recategorized WISC-R Scores

Bannatyne (1974) recategorized the Wechsler (1974) subtests into four groups (Spatial Ability, Verbal Conceptualizing, Sequencing Ability, and Acquired Knowledge) to identify a typical learning-disabled pattern (see Table 4). Spatial Ability includes Picture Completion, Block Design, and Object Assembly. Verbal Conceptualizing is comprised of Comprehension, Similarities, and Vocabulary. Sequencing Ability is composed of Digit Span, Arithmetic, and Coding. Acquired Knowledge includes Information,

Table 3

Subtest Loadings for Two- and Three-Factor Solutions

| Researcher(s) | Subjects | N | Factors and Loadings |
|---|---|---|---|
| Kaufman (1975)<br>Silverstein (1977) | Normative Sample | 2,200 | Verbal Comprehension: Information, Similarities, Vocabulary, Comprehension<br>Perceptual Organization: Picture Completion, Picture Arrangement, Block Design, Object Assembly, Mazes<br><br>Freedom from Distractibility: Arithmetic, Digit Span, Coding |
| Reschly (1978) | Tohono O'odham | 202 | Factor 1: Vocabulary, Comprehension, Information, Similarities<br><br>Factor 2: Block Design, Picture Completion, Object Assembly, Mazes<br><br>Factor 3: not interpretable |

Table 3--Continued

| Researcher(s) | Subjects | N | Factors and Loadings |
|---|---|---|---|
| Rousey (1990) | Latino | 613 | Factor 1: Information, Similarities, Vocabulary, Comprehension, Factor 2: Picture Completion, Picture Arrangement, Block Design, Object Assembly, Coding, Mazes Factor 3: Arithmetic, Digit Span |

Arithmetic, and Vocabulary. Bannatyne found that learning disabled students with a Full Scale IQ score greater than 75 scored in descending order as follows: Spatial -> Conceptual -> Sequential -> Acquired Knowledge. Several researchers utilized Bannatyne's categories in their research with Native American children. This research is discussed in the following paragraphs and is summarized in Table 4.

McShane and Plas utilized Bannatyne's recategorization scheme with a sample of 77 Ojibwa (1982c) and 52 Ojibwa and Sioux children (1984a). WISC, WISC-R, and WPPSI subtest scores were recategorized on an acculturated group, a group from a traditional Native American environment, and the total sample, and a pattern which differed from the learning disability and normal patterns. This pattern of Spatial -> Sequential -> Conceptual and Acquired Knowledge was evident for the total sample, as well as for the traditional group, but not for the acculturated group. It was defined by solid visual-spatial abilities, relative strength in sequential abilities, and depressed verbal-conceptual and acquired factual knowledge abilities. Scoring patterns of the more Anglo-acculturated Native American students were typically more like the normative group than the Indian group. These results support the hypothesis of the effects of traditional Indian heritage and cognitive style on WISC-R performance.

Table 4

Bannatyne's Recategorization

| Researcher(s) | Subjects | N* | Categories |
|---|---|---|---|
| Bannatyne (1974) | Normative Sample | 2,200 | Spatial Ability: Picture Completion Block Design Object Assembly Verbal Conceptualizing: Comprehension, Similarities, Vocabulary Sequencing: Digit Span, Arithmetic, Coding Acquired Knowledge: Information, Arithmetic, Vocabulary |
| McShane & Plas (1982) | Ojibwa & Sioux | 105 Ref<br>20 OM<br>17 GP | Spatial > Sequential > Acquired Knowledge (all three groups) |
| Connelly (1983) | Tlingit Ref<br>6-10 years<br>11-16 years | <br>61<br>84 | <br>Spatial> Sequential> Conceptual and Acquired Knowledge (both groups) |
| Zarske & Moore (1982) | Navajo, LD Reservation | 192 | Spatial> Sequential> Conceptual |
| Mishra (1984) | O'dham | 46 | Spatial> Conceptual> Sequential<br>* = no significant differences |

* Ref = Referred GP = Gifted Potential
OM = Otitis Media

Connelly (1983) studied the Bannatyne (1974) recategorization scheme using a younger and an older group of referred Tlingit Indian children in southeastern Alaska and found significant results for both groups. The pattern of recategorized WISC-R scores was demonstrated for 61% of the older students and 33% of the younger students.

Zarske and Moore (1982) used Bannatyne's (1974) recategorized scores to determine an LD pattern, with 192 learning-disabled Navajo children. The subjects did not demonstrate Bannatyne's typical LD pattern and the authors concluded that the Conceptual scores may be related to English as a second language and cultural factors. Although Zarske and Moore did not mention a scoring pattern characteristic of Native Americans in their study, their results support the typical Indian scoring pattern found by McShane and Plas (1982c, 1984a) and Connelly (1983).

Mishra (1984) investigated Bannatyne's (1974) recategorized WISC-R scores for a learning disabilities profile using a sample of Tohono O'odham children. Rank ordering of factors did demonstrate the LD pattern, but there was not a significant difference between the mean scores of the Conceptual and Spatial categories. Gutkin (1979) did not find a learning disability pattern when he used Bannatyne's recategorized scores with Mexican-American children. Results of both studies impugn the

generalizability of Bannatyne's recategorized scores for diagnosing learning disabled children in minority cultures.

Although Bannatyne's (1974) recategorization scheme may not be useful for the diagnosis of learning-disabled Mexican-American and American Indian children, the scheme may indicate a typical scoring pattern for students from traditional Native American environments.

## Information Processing

As cited by Browne (1984), Ornstein (1972) hypothesized that the emphasis on information processing strategies in a specific cerebral hemisphere may be culturally bound, and Cattey (1980) and Ross (1982) found that the American Indian culture seemed to be right-hemisphere-processing oriented. The Plains Indians of Browne's study scored highest on subtests identified as "right brain," which indicates greater strength in relational, holistic, informational processing.

As shown in Table 5, the Luria-Das Model of simultaneous and successive factors did exist in a sample of gifted and learning disabled Navajo children (Mishra, Lord, & Sabers, 1989). Similarities, the marker test for the simultaneous factor according to Das (1972), as cited by Mishra et al., loaded on the successive factor for the gifted group and on the simultaneous factor for the learning-disabled group. This suggests that the two groups

Table 5

Simultaneous-Successive Factors

| Researcher(s) | Subjects | N | Factors & Subtests |
|---|---|---|---|
| Browne (1984) Plains | Northern subtests | 197 | Rank order of indicates right brain strength: Mazes, Object Assembly, Picture Completion, Block Design |
| Mishra et al. (1989) | Navajo LD | 45 | Simultaneous Factor: Object Assembly, Picture Completion, Similarities, Picture Arrangement Successive Factor: Digit Span, Coding, Picture Arrangement |
| | Gifted | 41 | Simultaneous Factor: Picture Completion, Object Assembly, Block Design Successive Factor: Digit Span, Coding, Similarities |

may approach the tasks on the Similarities subtest with different information-processing modes.

Identification of information processing strategies and cognitive strengths can serve as guidelines for educational programming (Browne, 1984). Krywaniuk and Das (1976) successfully used remediation strategies with a group of third and fourth-grade Canadian Indian children who performed poorly on processing tasks in a set of cognitive and intelligence tests. This clearly implies that identification of sequential or simultaneous cognitive strengths can be valuable for educational planning and remediation. However, the simultaneous - successive factor construct is not useful, as was the case with McShane and Plas' (1982c) sample of Ojibwa reservation children. Consequently, further studies of reservation and non-reservation groups, as well as cross-tribal studies, must be conducted before generalizing underlying factors of performance by Native Americans on the WISC-R.

## Predictive Validity

Standardized tests are commonly used to make educational placement decisions and to predict academic success in school. Bias occurs in predictive validity when there are consistent errors in making inferences or predictions for specific groups. Bias in predictability results in unfair practices such as inappropriate placement

in lower-functioning classrooms, lack of access to gifted education, or no special placement when such placement would be beneficial (Reynolds, 1982).

In a study of Columbia Basin American Indians, McCullough, Walker, and Diessner (1985) confirmed their hypothesis that the Verbal and Full Scale scores were good predictors of reading achievement. The Verbal Scale was a fair predictor of math achievement. The authors noted that since the Full Scale score was a better predictor of reading achievement than the Verbal and Performance scores, the Verbal scale may be assessing cultural differences in knowledge acquisition rather than verbal abilities. McCullough et al. found that the Verbal and Performance scales had such a low correlation that the Full Scale score was not an accurate representation of the "g" factor or general intelligence.

Mishra and Lord (1982) found no significant correlation between the WISC-R IQ scales and achievement in a sample of Navajo students. Using the WISC-R as a predictor of achievement for Navajo students is, therefore, of questionable value. Lack of variability within the sample may have resulted in depressed coefficients of reliability and validity. Since the mean performance was lower, especially on the Verbal scale, low correlations may have resulted because the tests were reduced in length.

Generalizability of the Mishra and Lord study is limited to Navajos from a low socioeconomic background who live in isolated areas on the reservation. Findings from a sample of more acculturated Navajo students may produce different results. Mishra and Lord suggest further studies using larger samples with different age groups and ethnocultural characteristics.

In a stratified random sample of Tohono O'odham, Hispanic, Black, and Anglo students, Reschley and Reschley (1979) found a significant correlation between the WISC-R IQ scales and Reading and Math sections of the Metropolitan Achievement Test. Correlations for the Tohono O'odham students were consistently lower than those for other groups. The best predictors of achievement were the Verbal Comprehension factor and the Full Scale IQ. Freedom from Distractibility was a better predictor of achievement than Perceptual Organization and possibly a better predictor of teacher ratings of achievement than the Full Scale and Verbal Comprehension scores. Reschley and Reschley concluded that their data confirmed a relatively strong relationship between WISC-R scores and achievement for most Anglo and non-Anglo groups with the exception of the Tohono O'odham. Further, they determined that the Verbal Scale is probably a better predictor of school aptitude than Full

Scale or Performance scores when there is a discrepancy between the Verbal and Performance Scales.

Palmer et al. (1989) found predictive bias in a study of referred and nonreferred LEP and non-LEP Hispanic children in that both the Kaufman-Assessment Battery for Children and WISC-R IQ scores overpredicted the achievement functioning of Hispanics, possibly leading to the overidentification of students with severe discrepancies. When regressed on the K-ABC total achievement and Reading Understanding Scales, the study also revealed bias based on language dominance, suggesting that Hispanic LEP students may be overrepresented in special education classes.

Discrepancies in predictability studies necessitate cautious use of the WISC-R for predicting academic success (see Table 6). Studies examining predictability demonstrated lower correlation between the WISC-R scales and achievement than for the normed groups (McCullough et al., 1985; Mishra & Lord, 1982; Reschly & Reschly, 1979). Results of these studies are not generalizable to groups other than those sampled, due to the varied results of the studies as well as language and cultural differences among various groups.

Table 6

Reliability and Predictability

| Researcher(s) | Subjects | N | Test+ | | Reliability with VIQ | PIQ | FSIQ |
|---|---|---|---|---|---|---|---|
| Reschley & Reschley (1979) | O'dham | 202 | MAT | Reading | | | .41* |
| | | | | Spelling | | | |
| | | | | Arithmetic | | | .39* |
| Mishra & Lord (1982) | Navajo | 40 | WRAT | Reading | .20 | .22 | .20 |
| | | | | Spelling | .19 | .18 | .20 |
| | | | | Arithmetic | .15 | .17 | .16 |
| McCullough et al. (1985) | Columbia River Basin | 75 | STEP | Reading | .61** | | .68** |
| | | | | Spelling | | | |

* $p < .01$. ** $p < .001$.

+ MAT = Metropolitan Achievement Test
WRAT = Wide Range Achievement Test
STEP = Sequential Tests of Educational Progress

## Factors Affecting Test Performance

WISC-R studies of American Indian children have suggested an overall direction of low performance on the Verbal subtests (Hynd, et al., 1979; McShane, 1980; Teeter et al., 1982). Physiological and social/cultural factors may account for poor performance by American Indians on tests requiring language skills (McShane, 1980).

Physiological factors include otitis media, fetal alcohol syndrome, and elevated blood lead levels. The prevalence of otitis media among the American Indian population has been documented by many researchers (Kaplan, Fleshman, Bender, Baum, & Clark, 1973; McShane, 1980; McShane & Mitchell, 1979; McShane & Plas, 1982a, 1984a; Scaldwell & Frame, 1985; Stewart, 1975). Otitis media is a middle-ear infection in which fluids accumulate or there is negative pressure behind the eardrum. Short- and long-term effects of otitis media include hearing loss, poor auditory sequential memory, poor ability for sound blending and closure, delayed auditory perceptual skills, and language and educational delays. Wallace (1973) concluded that otitis media was the most significant health problem among Native Americans. Kaplan et al. found that WISC Verbal scores had a negative correlation with the number of diagnosed otitis media episodes in an Eskimo sample. Auditory tasks as a part of the testing process may result

in low sequencing scores compared to relatively strong visual spatial scores. This researcher has observed that many children with delayed language and learning disabilities have a history of numerous otitis media episodes with intermittent hearing loss.

Alcoholism is a widespread disease among many American Indian groups (Wallace, 1973). Fetal Alcohol Syndrome (FAS) is an abnormality that occurs when a pregnant mother consumes excessive amounts of alcohol. FAS has been ranked as the primary cause of mental retardation (May, 1981).

Data from the second National Health and Nutrition Examination Survey (Mahaffey, Amnest, Roberts, & Murphy, 1982) indicate that young children, poor people, rural residents, males, and Blacks are at higher risk for elevated blood lead levels. McShane and Plas (1984a) suggested that lead exposure may contribute to the Wechsler (1974) performance patterns of Native American children.

Numerous differences between mainstream and American Indian cultures may impact performance on the Verbal subtests of the WISC-R. Bogen (1969) suggested that early cultural experiences may affect whether thought is simultaneous (holistic or right brain) or sequential (left brain). Recent studies by Mishra, Lord, and Sabers (1989) and Brown (1984) concurred with this hypothesis. Hynd and Garcia (1979) concluded that Verbal subtest scores may be

affected by cultural behavior which is nonassertive, minimizes rapport, and has little spontaneous verbal interaction or eye contact. They also discussed the cultural belief that self-disclosure to a stranger reduces one's self-control; thus if pressured by an examiner, a student may become passive or withdrawn. In addition, test content was to be irrelevant to reservation life.

McShane and Plas (1982b) administered a Traditional Experience Scale (TES) to assess the acculturation of the mothers of 15 children (a very small sample). The scale included fluency of the native language and attendance at ceremonial rituals. Children with highly traditional mothers had mean Verbal-Performance differences of 25 points, while children of moderately traditional mothers had mean differences of 16 points, and children of mothers with little experience in traditional practices had mean differences of zero.

McShane and Plas (1982b) believed that well-developed spatial abilities "may result from the traditional Indian emphasis on the concrete reality and individuality of objects, an orientation that may obscure for the Indian child any overriding equivalence or available generalization within a group of objects" (p. 14). Concrete reality refers to an acute perception of the environment in which an object is named in accordance with its specific relationship to a

particular time and space. For example, an object such as a snowflake has numerous names, one of which is chosen to describe the size, wetness, weight, shape, etc., of the snowflake.

Low Verbal IQ scores may not reflect ability but instead indicate English as a second language or other cultural factors (Zarske & Moore, 1982; Fourquean, 1987). McShane and Plas (1984a) cited several authors (Hall, 1969; Darnell, 1979; Guilmet, 1978) who discussed non-verbal communications that may affect the acquisition of visual-spatial strengths in American Indian children. These children spoke less and observed other students and their teachers more than their non-Indian counterparts. In their literature review, McShane and Plas found that Indian children may receive, process, and express language through modalities that are not distinctly verbal. Consequently, they reasoned that WISC-R Performance subtests may represent an "Indian Verbal IQ" of communication and thought. Additionally, cultural roles and rules may affect the testing situation.

# CHAPTER 3

# METHODOLOGY

The purpose of this chapter is to discuss the procedures used in the current study. Included are a description of the sample, a brief description of the instruments used and the testing procedures, the hypotheses that were tested, and a description of the statistical procedures used to test the hypotheses.

## Sample

The 176 subjects who participated in this study were students enrolled in a small elementary school district in a large Southwestern city. All students had been referred for a psychoeducational evaluation based on academic difficulties they were experiencing within the regular classroom. The purpose of the evaluation was to determine eligibility for special education services as learning-disabled students or to reevaluate students who had previously been placed in the learning-disability program. The subjects were subdivided into three groups by ethnicity: Anglo, American Indian, and Hispanic. Subjects ranged in grade level from first through eighth grade. All three groups were matched for socioeconomic status, which was determined by residency in the same geographical region of the city. All district schools qualified for the Federal

free lunch program. Table 7 specifies the characteristics of the subjects and the sample size.

## Instrumentation

According to Wechsler (1974), "Intelligence is the overall capacity of an individual to understand and cope with the world around him" (p. 5). Wechsler explained that this definition departs from other definitions of intelligence in two ways: (1) intelligence is a global entity which is "multidetermined and multifaceted" as opposed to an "independent, uniquely-defined trait" (p. 5) and (2) no one ability is critically important. This definition does not equate general intelligence with intellectual ability. Wechsler maintained that "intelligence is not a kind of ability at all, . . . rather it is something that is inferred from the way these abilities are manifested under different conditions and circumstances" (p. 5).

The Wechsler (1974) Intelligence Scales for Children-Revised (WISC-R) is the most commonly used intelligence test for the pychoeducational assessment of school-aged children. The WISC-R is composed of Verbal and Performance Scales from which separate Intelligent Quotient (IQ) scores are generated, as well as a Full Scale IQ score. The Verbal Scale is comprised of five requisite subtests as well as a sixth optional subtest. The Verbal subtests,

Table 7

Sample Size and Characteristics of Subjects

| | Subjects | Grade Range | Gender | | |
|---|---|---|---|---|---|
| | | | M | F | U* |
| Anglo | 64 | 1-8 | 37 | 19 | 8 |
| Hispanic | 64 | 1-8 | 44 | 16 | 4 |
| American Indian | 48 | 1-8 | 29 | 17 | 2 |

* = unknown

which are administered verbally and require verbal responses, assess verbal comprehension skills. The Performance Scale is comprised of five requisite subtests and one optional subtest. The Performance subtests require a motor responses and assess perceptual organization skills.

The WISC-R standardization sample included 2,200 "normal" children and was stratified on five variables (age, gender, race, geographic region, and occupational group of head of household) according to 1970 Census data. The race variable was subdivided into whites and nonwhites. "Nonwhites included blacks and also other nonwhite groups such as American Indians and Orientals" (Wechsler, 1974, p. 17). The total standardization sample included 330 nonwhites, 305 (92.4%) of whom were black. Hispanic children were classified as white or nonwhite in accordance with physical characteristics as judged by the examiner. The number of American Indian and nonwhite Hispanic subjects in the standardization sample was not cited in the WISC-R Manual.

## Testing Procedures

The subjects of this study were administered the Wechsler (1974) Intelligence Scale for Children-Revised (WISC-R) (Wechsler, 1974) by a certified school psychologist in an appropriate environment and accordance with the standardized procedures outlined in the WISC-R Manual.

Students were referred for psychoeducational evaluation by members of the Student Study Team who reviewed referrals by individual teachers.

## Hypotheses

The following null hypotheses were tested:

1. The mean differences between Verbal and Performance scores will not be significant for each group.
2. The underlying factor structure for Anglo, Hispanic, and American Indian children will be the same.
3. The factor structure for Hispanic and American Indian students will be identical to that of Anglo students.

## Statistical Analysis

Consistent with the hypotheses, three types of statistical procedures were employed to examine the data. Mean differences were examined for significance according to Kaufman's (1979) guidelines. An exploratory factor analysis was used to examine the underlying factor structure for each group of subjects. Confirmatory factor analysis was used to compare the equivalence of hypothesized factor structures across groups.

Verbal-Performance Scale discrepancies were computed and examined for significant discrepancies. According to Kaufman (1979), "The size of V-P IQ differences required for

statistical significance is 9 points ($p < 0.15$), 12 points ($p < 0.05$), and 15 points ($p < 0.01$). For V-P comparisons, I consider 12 points to be a difference that is worthy of explanation" (p. 24). Kaufman (1981) reported that a 10 point V-P discrepancy averages about 10 points without regard to direction. He also reported that 25% of normal children have V-P discrepancies of 15 or more points which is significant at the .01 level.

Two types of factor analytic techniques were used in the current study. Factor analytic techniques reduce data by creating a set of common factors which represent the source of variation in at least two observed variables (Kim & Mueller, 1978a). The two methods of factor analysis are exploratory and confirmatory. In exploratory factor analysis, the number of factors to be extracted from the data is not specified. In confirmatory factor analysis, the number of factors and their loadings are hypothesized by the researcher.

Hypothesis 2 stated that the underlying factor structure for Anglo, Hispanic, and American Indian children would be the same. SPSS-X, an exploratory factor analysis program (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1990), was used to determine the latent structure or underlying factor structure for each of the three groups by extracting an unspecified number of factors from each group. In

preparation for the analysis, standard scores were transformed into a correlation matrix to allow for direct comparison of variables (Dillon & Goldstein, 1984). The correlation matrix was subjected to a principal-components analysis and, subsequently, a principal-axis factoring.

Principal-components analysis is a statistical method used to determine how much each variable contributes to the variance in the data by extracting the principal components or factors which account for as much variance in the data as possible. Principal-components analysis is a hierarchical decomposition of a correlation matrix of which each component is a linear combination of the observed variables. The first principal component accounts for the largest amount of variance in the data. The second principal component accounts for the maximum amount of remaining variance, and so on. Eigenvalues are the basis of generating each of the components.

Principal-axis factoring, a method of initial factoring, was used to determine the portion of total variance shared by the variables (Dillon & Goldstein, 1984). By examining the eigenvalues of the principal components and adhering to the rule-of-thumb eigenvalue criterion of greater than or equal to 1, the initial number of factors to be extracted was determined (Kim & Mueller, 1978a). The first factor is a weighted combination of variables which

maximally accounts for variance in the correlation matrix, the second accounts for maximal remaining variance, etc. An unrotated factor matrix was produced.

Next, the varimax method of orthogonal rotation was employed to interpret the variables in a more parsimonious manner by rotating the axes to maximize and minimize differences in the factors. The varimax method of orthogonal rotation maximizes the variance of the squared factor loadings for a given factor. Distinctive properties of orthogonal rotation are (1) resulting factors remain statistically unrelated; (2) values of communality estimates (the sums of the squared factor loadings in orthogonal rotation) will not be altered after rotation; however, the proportion of a variable's variance accounted for by a given factor will be changed; (3) the percentage of variance accounted for by an individual factor will usually be different, thus no significance is attached to factor order (Kim & Mueller, 1978a). The percentage of variance indicates how much variance is accounted for by the first factor. The second factor accounts for variance not explained by the first factor, and the third factor accounts for the remaining variance not explained by the first two factors.

The third hypothesis stated that Anglo, Hispanic, and American Indian students would have the same factor

structures. EQS (Bentler, 1989), a computer program using confirmatory factor analysis, was used to test several hypothesized factor structures. As in the exploratory factor analysis, three steps are involved in confirmatory factor analysis: preparation of a covariance matrix, extraction of initial factors, and rotation to a terminal solution. In the present analysis, the maximum likelihood solution and generalized least squares solutions were used to extract the indicated initial factors (Kim & Mueller, 1978b).

The maximum likelihood solution is a method of statistical analysis which estimates the population parameters having the greatest likelihood of producing the observed sample distribution (Kim & Mueller, 1978b). The resultant goodness of fit summary generates a chi-square statistic, the degrees of freedom, and the probability value for the chi-square statistic. Better-fitting models (smaller differences between the two matrices) are indicated by smaller chi-square values which evaluate the fit between the factor solution and the observed data. The degrees of freedom are the difference between the total number of unique entries in the covariance matrix (the observed variances/covariances) and the total number of coefficients estimated in the model (Hayduk, 1987). Larger degrees of freedom come closer to guaranteeing the

prediction of an acceptably fitting model. The probability level indicates how often the sample population would differ to that degree from the model provided and whether the model indicated the true covariance matrix. A probability level of .20 indicates that the difference of the sample from the model should occur in 1 of 5 samples. A probability level of .10 or greater is commonly accepted for a model to fit the sample data (Bentler & Bonett, 1980). In summary, a smaller chi-square value and higher probability level indicate a better fit for the model in confirmatory factor analysis.

To compare factor structures across groups, a confirmatory factor analysis was also applied to a model hypothesized from variable loadings on factors as a result of the generalized least squares solution. Generalized least squares minimize the squared deviations between the observed values and predicted values (Kim & Mueller, 1978b). Parameters were constrained by specifying the equality of individual variables. Factor structures were compared between each group and across the three groups. Degrees of freedom are increased with an appropriate model. This statistical analysis results in the goodness of fit summary which includes a chi-square statistic, degrees of freedom, and a probability level.

# CHAPTER 4

# RESULTS

The purpose of the present investigation was to examine performance patterns of Anglo, Hispanic, and American Indian children on the WISC-R. This chapter is a presentation of the data collected and the statistical analyses employed to address the hypotheses. The hypotheses are restated and followed by the results. The means and standard deviations of each subtest are presented and discussed. Discrepancies between the Verbal and Performance Scale scores are reviewed for statistical significance. An explanation of the principal-components factor analysis precedes the outcome of the underlying factor structures for the Anglo, Hispanic, and American Indian subjects. An explanation of EQS confirmatory factor analysis is followed by the results.

## Results Related to Hypothesis 1

The goal of the first analysis was to determine whether significant differences existed between the Verbal and Performance scores for each group. Group mean profiles were prepared for the total group and for the subgroups by ethnicity. Table 8 lists the means and standard deviations for each subtest, as well as the Verbal, Performance, and Full Scale IQ mean scores. The mean score for the IQ scales is set to equal 100, and one standard deviation is set to

Table 8

WISC-R Means and Standard Deviations

| | Anglo | | Hispanic | | American Indian | |
|---|---|---|---|---|---|---|
| Verbal Subtests | $\bar{X}$ | (SD) | $\bar{X}$ | (SD) | $\bar{X}$ | (SD) |
| Information | 7.72 | (2.24) | 5.50 | (2.66) | 6.96 | (2.62) |
| Similarities | 10.03 | (2.73) | 8.45 | (2.87) | 8.58 | (3.13) |
| Arithmetic | 8.03 | (2.08) | 7.26 | (2.09) | 7.00 | (2.37) |
| Vocabulary | 9.16 | (2.74) | 7.00 | (2.60) | 7.14 | (3.09) |
| Comprehension | 9.97 | (2.65) | 8.22 | (3.32) | 7.25 | (2.40) |
| Digit Span | 7.70 | (2.62) | 7.26 | (2.80) | 6.98 | (2.85) |
| Verbal IQ | 93.31 | (11.86) | 82.97 | (13.24) | 84.21 | (13.60) |
| Performance Subtests | | | | | | |
| Picture Completion | 10.64 | (2.54) | 10.22 | (2.40) | 10.04 | (2.19) |
| Picture Arrangement | 10.42 | (2.61) | 10.02 | (2.56) | 10.31 | (2.89) |
| Block Design | 10.33 | (2.44) | 9.83 | (2.68) | 9.73 | (2.94) |
| Object Assembly | 10.23 | (3.16) | 10.36 | (2.51) | 10.96 | (2.99) |
| Coding | 8.28 | (2.72) | 8.75 | (2.64) | 8.48 | (2.86) |
| Performance IQ | 99.62 | (11.43) | 98.44 | (10.54) | 99.19 | (9.70) |
| Full Scale IQ | 95.86 | (10.99) | 89.33 | (10.37) | 90.27 | (10.99) |
| Verbal-Performance Mean IQ differences | 6.31 | | 15.47* | | 14.98* | |

*$p < 0.01$

Table 9

Means Based on Two and Three Factor Solutions

| | Anglo | Hispanic | American Indian |
|---|---|---|---|
| Two Factors | | | |
| Verbal Subtests | 8.81 | 7.28 | 7.32 |
| Performance Subtests | 9.98 | 9.84 | 9.91 |
| Three factors | | | |
| Verbal Comprehension | 9.22 | 7.29 | 7.49 |
| Perceptual Organization | 10.40 | 10.10 | 10.26 |
| Freedom from Distractibility | 8.00 | 7.76 | 7.48 |

equal 15 points (Wechsler, 1974). Table 9 is a presentation of the means for each ethnic group based on two- and three-factor solutions. Verbal and Performance Score mean differences are considered significant at 9 points ($p < 0.15$), 12 points ($p < 0.05$), and 15 points ($p < 0.01$) (Kaufman, 1979).

For the Anglo group, Verbal subtest mean scores ranged from 7.7 on Digit Span and Information to 10.0 on Similarities. The Verbal IQ mean score of 93.3 was 6.31 points less than the Performance IQ mean score of 99.6. This discrepancy is not significant. The Verbal IQ score and the Performance IQ score were within the average range according to Wechsler's (1974) criteria. There were no significant weaknesses or strengths among the individual Performance subtests, whose scores ranged from 7.70 (Digit Span) to 10.64 (Picture Completion). Differences among the means for a three-factor solution were computed and were not found to be significant.

For the Hispanic group, the Verbal subtest mean scores ranged from 5.5 on Information to 8.4 on Similarities. The Verbal IQ mean score of 82.97 was within the low average range. No significant strengths or weaknesses were indicated on the individual subtests. The Performance mean score of 98.44 was within the average range. The 15-point difference (one standard deviation) between the Verbal and

Performance subtests ranged from 8.75 on Coding to 10.36 on Object Assembly. All Performance subtests were within the average range, and there were no significant strengths or weaknesses. Mean scores for a three-factor solution were Verbal Comprehension, 7.29; Perceptual Organization, 10.10; and Freedom from Distractibility, 7.76. The Verbal Comprehension and Freedom from Distractibility mean scores were within the low average range, while the Perceptual Organization mean was within the average range.

For the American Indian subjects, the Verbal subtest scores ranged from 7.0 on Information, Arithmetic, and Digit Span to 8.6 on Similarities. The Verbal IQ mean score of 84.2 was within the low average range. There were no significant strengths or weaknesses on the individual Verbal subtests. The Performance mean score of 99.2 was within the average range. Performance subtest scores ranged from 8.48 on Coding to 10.96 on Object Assembly. The 15-point difference (one standard deviation) between the Verbal and Performance mean scores was significant ($p < 0.05$). No significant strengths or weaknesses were noted among the individual Performance subtests. Mean scores of a three factor solution were Verbal Comprehension, 7.48; Perceptual Organization, 10.26; and Freedom from Distractibility, 7.48. Perceptual Organization was within the average range, while

Verbal Comprehension and Freedom from Distractibility were within the low average range.

Verbal and Performance Score mean differences were computed. All groups obtained mean differences between the Verbal and Performance subtest scores. The mean difference of 15 points for the Hispanic and American Indian groups was significant at the $p < 0.05$ level. Performance IQ scores were within the average range for all three groups. Verbal IQ scores fell within the average range for the Anglo group and within the low average range for the Hispanic and American Indian groups.

Means based on a three-factor solution were computed for all three groups. All groups obtained their highest mean score on the Perceptual Organization factor, ranging from 10.10 to 10.40. The means for the Anglo group were approximately one point different in this descending order: Perceptual Organization, Verbal Comprehension, and Freedom from Distractibility. Minor differences were noted between the Hispanic and American Indian mean scores for the three factors; however, mean scores for the Perceptual Organization factor were approximately three points higher than the obtained means for Verbal Comprehension and Freedom from Distractibility factors.

A rank ordering of subtest means from the highest to lowest score was prepared for each group and is presented in

Table 10. All groups scored highest on Object Assembly, Picture Arrangement, Picture Completion, and Block Design. All groups scored lowest on the Information subtest.

## Results Related to Hypothesis 2

Hypothesis 2 stated that the underlying factor structure for Anglo, Hispanic, and American Indian children would be equivalent. The SPSS-X exploratory factor analysis program (Nie et al., 1990) was used to investigate the underlying factor structure of each group of subjects.

In preparation for the principal-components analysis, correlation matrices were constructed for each group. The correlation matrices and their corresponding correlation coefficients for this study are presented in Tables 11-16. The varimax rotated factor matrices, eigenvalues, and percentage of variance are reported in Table 17.

Principal-axis factoring with varimax rotation yielded three factors with eigenvalues greater than 1.0 for the Anglo group. The three factors explained 59.6% of the variance. Factor 1 accounted for 35.4% of the variance, Factor 2 accounted for 13.8% of the variance, and Factor 3 explained 10.4% of the variance. The resultant factors were those defined by Kaufman (1975): Verbal Comprehension, Perceptual Organization, and Freedom from Distractibility. Information (.76), Similarities (.50), Arithmetic (.43), Vocabulary (.66), Comprehension (.75), Digit Span (.37), and

Table 10

Rank Ordering of Subtest Means for Each Group and Total Group

| WISC-R Subtests | Anglo (N = 64) | Hispanic (N = 64) | American Indian (N = 48) | Total (N = 178) |
|---|---|---|---|---|
| Object Assembly | 4 | 1 | 1 | 1 |
| Picture Arrangement | 2 | 3 | 2 | 3 |
| Picture Completion | 1 | 2 | 3 | 2 |
| Block Design | 3 | 4 | 4 | 4 |
| Similarities | 5 | 6 | 5 | 5 |
| Coding | 8 | 5 | 6 | 7 |
| Comprehension | 6 | 7 | 7 | 6 |
| Vocabulary | 7 | 10 | 8 | 8 |
| Arithmetic | 9 | 8.5 | 9 | 9 |
| Digit Span | 11 | 8.5 | 10 | 10 |
| Information | 10 | 11 | 11 | 11 |

Note: 1 = the highest score, 2 = the lowest score.

Table 11

Correlation Coefficients for the Anglo Group

| | Info | Sim | Arith | Voc | Comp | DS | PC | PA | BD | OA | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Info | 1.00 | | | | | | | | | | |
| Sim | .338** | 1.00 | | | | | | | | | |
| Arith | .387** | .512** | 1.00 | | | | | | | | |
| Voc | .470** | .504** | .390** | 1.00 | | | | | | | |
| Comp | .518** | .556** | .429** | .643** | 1.00 | | | | | | |
| DS | .274* | .270* | .305* | .332** | .358** | 1.00 | | | | | |
| PC | .110 | .310* | .164 | .220 | .163 | .057 | 1.00 | | | | |
| PA | -.012 | .287* | .346** | .255* | .220 | .244 | .329** | 1.00 | | | |
| BD | .286* | .339** | .298* | .348** | .489** | .170 | .280* | .254* | 1.00 | | |
| OA | .099 | .196 | .197 | .258* | .315* | .011 | .384** | .449** | .393** | 1.00 | |
| Co | - .049 | .208 | .238 | .088 | .168 | .170 | - .089 | .039 | .184 | -.061 | 1.00 |

* Significance is less than or equal to .05 (2-tailed)
** Significance is less than or equal to .01 (2-tailed)

Note: The following abbreviations are used in Tables 11, 13, 15, and 17:
Info = Information
Sim = Similarities
Arith = Arithmetic
Voc = Vocabulary
Comp = Comprehension
DS = Digit Span
PC = Picture Completion
PA = Picture Arrangement
BD = Block Design
OA = Object Assembly
Co = Coding

Table 12

Very Significant and Significant Intercorrelations by Subtest for the Anglo Group

| | |
|---|---|
| Information: | Similarities,** Arithmetic,** Vocabulary,** Comprehension,** Digit Span,* Block Design** |
| Similarities: | Information,** Arithmetic,** Vocabulary,** Comprehension,** Digit Span,* Picture Completion,* Picture Arrangement,* Block Design** |
| Arithmetic: | Information,** Similarities,** Vocabulary,** Comprehension,** Digit Span,* Picture Arrangement,** Block Design,* |
| Vocabulary: | Information,** Similarities,** Arithmetic,** Comprehension,** Picture Arrangement,* Block Design,** Object Assembly,* |
| Comprehension: | Information,** Similarities,** Arithmetic,* Vocabulary,** Digit Span,** Block Design,* Object Assembly,* |
| Digit Span: | Information,* Similarities,* Arithmetic,* Vocabulary,** Comprehension** |
| Picture Completion: | Similarities,* Picture Arrangement,** Block Design,* Object Assembly** |
| Picture Arrangement: | Similarities,* Arithmetic,** Vocabulary,* Picture Completion,** Block Design,* Object Assembly** |
| Block Design: | Information,* Similarities,** Arithmetic,* Vocabulary,** Comprehension,** Picture Completion,* Picture Arrangement,* Object Assembly* |

Table 12--Continued

| | |
|---|---|
| Object Assembly: | Vocabulary,* Comprehension,* Picture Completion,** Picture Arrangement,** Block Design,** |
| Coding: | no significant correlations |

* Significance is less than or equal to .05 (2-tailed)
** Significance is less than or equal to .01 (2-tailed)

Table 13

Correlation Coefficients for the Hispanic Group

| | Info | Sim | Arith | Voc | Comp | DS | PC | PA | BD | OA | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Info | 1.00 | | | | | | | | | | |
| Sim | .570** | 1.00 | | | | | | | | | |
| Arith | .316* | .276* | 1.00 | | | | | | | | |
| Voc | .661** | .693** | .468** | 1.00 | | | | | | | |
| Comp | .458** | .723** | .374** | .638** | 1.00 | | | | | | |
| DS | .234 | .238 | .407** | .186 | .395** | 1.00 | | | | | |
| PC | .258* | .316* | .339** | .337** | .198 | .095 | 1.00 | | | | |
| PA | .236 | .116 | .261* | .234 | -.015 | -.014 | .347** | 1.00 | | | |
| BD | .171 | .275* | .253* | .344** | .310* | .180 | .218 | .095 | 1.00 | | |
| OA | .127 | .259* | .294* | .258* | .474** | .176 | .320** | .088 | .499** | 1.00 | |
| Co | .147 | -.152 | -.005 | .157 | -.077 | -.088 | .019 | .066 | -.017 | .160 | 1.00 |

* Significance is less than or equal to .05 (2-tailed)
** Significance is less than or equal to .01 (2-tailed)

Table 14

Very Significant and Significant Intercorrelations by Subtest for the Hispanic Group

| | |
|---|---|
| Information: | Similarities,** Arithmetic,* Vocabulary,** Comprehension,** Picture Completion,* |
| Similarities: | Information,** Arithmetic,* Vocabulary,** Comprehension,** Picture Completion,* Block Design*, Object Assembly,* |
| Arithmetic: | Information,* Similarities,* Vocabulary,** Comprehension,** Digit Span,** Picture Completion,* Picture Arrangement,* Block Design,* Object Assembly,* |
| Vocabulary: | Information,** Similarities,** Arithmetic,** Comprehension,** Picture Completion,** Block Design,** Object Assembly,** |
| Comprehension: | Information,** Similarities,** Arithmetic,** Vocabulary,** Digit Span,** Block Design,* Object Assembly** |
| Digit Span: | Arithmetic,** Comprehension,** |
| Picture Completion: | Information,* Similarities,* Arithmetic,** Vocabulary,** Picture Arrangement,** Object Assembly** |
| Picture Arrangement: | Arithmetic,* Picture Completion** |
| Block Design: | Similarities,* Arithmetic,* Vocabulary,** Comprehension,* Object Assembly** |
| Object Assembly: | Similarities,* Arithmetic,* Vocabulary,* Comprehension,** Picture Completion,** Block Design** |
| Coding: | no significant correlations |

* Significance is less than or equal to .05 (2-tailed)
** Significance is less than or equal to .01 (2-tailed)

Table 15

Correlation Coefficients for the American Indian Group

| | Info | Sim | Arith | Voc | Comp | DS | PC | PA | BD | OA | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Info | 1.00 | | | | | | | | | | |
| Sim | .593** | 1.00 | | | | | | | | | |
| Arith | .472** | .582** | 1.00 | | | | | | | | |
| Voc | .640** | .737** | .543** | 1.00 | | | | | | | |
| Comp | .488** | .602** | .490** | .734** | 1.00 | | | | | | |
| DS | .295* | .251 | .409** | .236 | .125 | 1.00 | | | | | |
| PC | .222 | .235 | .221 | .253 | .204 | .316* | 1.00 | | | | |
| PA | .195 | .446** | .205 | .420** | .368* | -.123 | .045 | 1.00 | | | |
| BD | .261 | .258 | .400** | .054 | .142 | .324* | .266 | .143 | 1.00 | | |
| OA | .312* | .268 | .120 | .125 | -.004 | .017 | .309* | .107 | .377** | 1.00 | |
| Co | -.080 | -.051 | .273 | -.001 | .094 | .340* | -.092 | -.085 | .198 | -.269 | 1.00 |

* Significance is less than or equal to .05 (2-tailed)
** Significance is less than or equal to .01 (2-tailed)

Table 16

Very Significant and Significant Intercorrelations by Subtest for the American Indian Group

| | |
|---|---|
| Information: | Similarities,** Arithmetic,** Vocabulary,** Comprehension,** Digit Span,* Object Assembly,* |
| Similarities: | Information,** Arithmetic,* Vocabulary,** Comprehension,** Picture Arrangement,** |
| Arithmetic: | Information,** Similarities,** Vocabulary,** Comprehension,** Digit Span,** Block Design,** |
| Vocabulary: | Information,** Similarities,** Arithmetic,** Comprehension,** Picture Arrangement,** |
| Comprehension: | Information,** Similarities,** Arithmetic,** Vocabulary,** Picture Arrangement* |
| Digit Span: | Information,* Arithmetic,** Picture Completion,* Block Design,* Coding,* |
| Picture Completion: | Digit Span,* Object Assembly,* Coding* |
| Picture Arrangement: | Similarities,** Vocabulary,** Comprehension,* |
| Block Design: | Arithmetic,** Object Assembly,** Coding** |
| Object Assembly: | Information,* Picture Completion,* Block Design,** |
| Coding: | Digit Span,* |

* Significance is less than or equal to .05 (2-tailed)
** Significance is less than or equal to .01 (2-tailed)

Table 17

Varimax Rotated Factor Matrices

| | Anglo (N = 63) 5 Iterations | | | Hispanic (N = 64) 15 Iterations | | | | Indian (N = 48) 4 Iterations | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Factors | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 1 | 2 | 3 |
| Info | .76 | -.01 | -.05 | .67 | .03 | .31 | -.05 | .60 | .36 | .10 |
| Sim | .50 | .29 | .40 | .79 | .19 | .10 | .20 | .79 | .30 | .08 |
| Arith | .43 | .24 | .45 | .24 | .28 | .50 | .26 | .54 | .28 | .50 |
| Voc | .66 | .26 | .19 | .78 | .22 | .34 | -.08 | .93 | .08 | .08 |
| Comp | .75 | .25 | .24 | .70 | .46 | -.04 | .28 | .77 | -.00 | .15 |
| DS | .34 | .06 | .34 | .20 | .23 | .14 | .42 | .12 | .29 | .62 |
| PC | .14 | .53 | -.04 | .18 | .24 | .49 | -.00 | .18 | .42 | .10 |
| PA | .04 | .63 | .28 | .08 | .01 | .52 | -.10 | .47 | .05 | -.14 |
| BD | .38 | .40 | .16 | .17 | .54 | .14 | .04 | .08 | .55 | .34 |
| OA | .14 | .74 | -.10 | .13 | .74 | .12 | -.05 | .07 | .79 | -.27 |
| Co | .04 | -.06 | .51 | .02 | .10 | .11 | -.48 | -.05 | -.15 | .65 |

Table 17--Continued

| | Anglo (N = 63) 5 Iterations | | | Hispanic (N = 64) 15 Iterations | | | | Indian (N = 48) 4 Iterations | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Factors | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 1 | 2 | 3 |
| * | 3.90 | 1.52 | 1.14 | 3.94 | 1.36 | 1.23 | 1.09 | 4.01 | 1.66 | 1.49 |
| ** | 35.4 | 13.8 | 10.4 | 35.8 | 12.3 | 11.2 | 9.9 | 36.5 | 15.1 | 13.6 |
| *** | 59.6% | | | 69.3% | | | | 65.1% | | |

Note: Loadings of up to 2 decimal points are reported.
* = Eigenvalues
** = Percentage of Variance
*** = Cumulative Percentage

| | Hispanic (N = 64) 6 Iterations | | |
|---|---|---|---|
| Factors | 1 | 2 | 3 |
| Info | .69 | .00 | .27 |
| Sim | .81 | .18 | - .01 |
| Arith | .39 | .29 | .29 |
| Voc | .80 | .16 | .30 |
| Comp | .78 | .47 | - .24 |
| DS | .32 | .24 | - .06 |
| PC | .25 | .25 | .45 |
| PA | .13 | .00 | .57 |
| BD | .21 | .49 | .13 |
| OA | .09 | .88 | .16 |
| Co | - .04 | .04 | .22 |
| * | 3.90 | 1.36 | 1.23 |
| ** | 35.8 | 12.3 | 11.2 |
| *** | | | 59.4% |

Block Design (.40) loaded on the first factor. Picture Completion (.53), Picture Arrangement (.63), Block Design (.40), and Object Assembly (.74) loaded on the second factor. Arithmetic (.45), Digit Span (.34), and Coding (.51) loaded on the third factor.

The principal-axis factoring analysis extracted four factors accounting for 69.3% of the variance for the Hispanic group. Factor 4 is not a true factor as only one subtest, Digit Span (.42) loaded on it. Factor 1 accounted for 35.8% of the variance, Factor 2 accounted for 12.3 % of the variance, Factor 3 accounted for 11.2% of the variance, and Factor 4 accounted for 9.9% of the variance. The first factor was composed of the five Verbal subtests: Information (.67), Similarities (.79), Vocabulary (.78), and Comprehension (.70). Factor 2 was comprised of Block Design (.54), and Object Assembly (.74). Picture Completion (.49) and Picture Arrangement (.52) loaded on Factor 3.

When a criteria of three factors was imposed for the Hispanic subjects, 59.4% of the variance was accounted for by the three factors. The first factor was composed of the first six Verbal subtests: Information (.69), Similarities (.821), Arithmetic (.39), Vocabulary (.80), Comprehension (.78), and Digit Span (.32). Block Design (.49) and Object Assembly (.88) comprised Factor 2. Factor 3 included

Picture Completion (.45), Picture Arrangement (.57), and Coding (.22).

Three factors accounting for 65.1% of the variance were extracted for the American Indian group. Factor 1 explained 36.5% of the variance, Factor 2 explained 15.1% of the variance, and Factor 3 explained 13.6% of the variance. Factor 1 consisted of the first five Verbal subtests and Picture Arrangement: Vocabulary (.93), Similarities (.79), Information (.60), Comprehension (.77), Arithmetic (.54), and Picture Arrangement (.47). Three Performance subtests loaded on Factor 2: Block Design (.55), Picture Completion (.42), and Object Assembly (.79). Factor 3 consisted of the Freedom from Distractibility subtests (Kaufman, 1975): Arithmetic (.50), Digit Span (.62), and Coding (.65).

In summary Information, Similarities, Arithmetic, Vocabulary, and Comprehension comprise a Verbal factor for all three groups in this study. Arithmetic loaded on Factor 1 and Factor 3 for the Anglo and Native American students. Digit Span loaded on both Factor 1 and Factor 3 for the Anglo students, although not strongly. Of the Verbal subtests, Digit Span and Arithmetic had the lowest loadings on Factor 1 for the Anglo and Hispanic subjects group. The remaining loadings on Factor 1 for all three groups were greater than or equal to .50 except Picture Arrangement (.47) for the Native American subjects.

Examination of the data for the Performance subtests revealed differences among the scoring patterns for the three groups. The three-factor structure extracted for the Anglo students was similar to that of the normative sample with Factor 2 being composed of Picture Completion, Picture Arrangement, Block Design, and Object Assembly; and Factor 3 being composed of Arithmetic, Digit Span, and Coding. Factor 2 for the American Indian students was slightly different. It was comprised of Picture Completion, Block Design, and Object Assembly. Picture Arrangement loaded on Factor 1. Factor 3 was similar to that of the normative group (Kaufman, 1975) and that of the Anglo group of this study: Arithmetic, Digit Span, and Coding. The Hispanic subjects demonstrated different Performance subtest scoring patterns. Factor 4 was not a true factor for the Hispanic group as it was comprised of Digit Span alone, therefore a three factor criteria was imposed upon the principal-axis factoring. Block Design and Object Assembly loaded on Factor 2. Factor 3 was comprised of Picture Completion, Picture Arrangement, and Coding.

The exploratory factor analysis resulted in the extraction of three factors for the Anglo and Native American students. Although four factors were extracted for the Hispanic students, the fourth factor was not a true factor as only one subtest, Digit Span, loaded on it.

## Results Related the Hypothesis 3

The third hypothesis stated that Anglo, Hispanic, and Indian students would have equivalent factor structures. A confirmatory factor analysis using the EQS computer program (Bentler, 1989) was used to test two hypothesized factor structures. Goodness-of-fit statistics for two confirmatory factor analyses are presented in Table 18. The two- and three-factor models fit for the Anglo group but not for the Hispanic and Native American groups. The two factor model was based on the Verbal subtests and the Performance subtests. Verbal subtests included Information, Similarities, Arithmetic, Vocabulary, Comprehension, and Digit Span. Performance subtests included Picture Completion, Picture Arrangement, Block Design, Object Assembly, and Coding. The three factor model was based upon Verbal Comprehension, Perceptual Organization, and Freedom from Distractibility. Verbal Comprehension subtests included Information, Similarities, Vocabulary, and Comprehension. Perceptual Organization includes Picture Completion, Picture Arrangement, Block Design, and Object Assembly. Freedom from Distractibility included Arithmetic, Digit Span, and Coding. For Hispanic and American Indian students the chi-square statistics were too high and the probability levels for both factor solutions were too low to confirm that these solutions fit for these groups.

Table 18

Goodness -of-Fit Statistics for the Maximum Liklehood Solution

| | Chi-Square | df | Probability |
|---|---|---|---|
| Three Factors: Verbal Comprehension, Perceptual Organization, and Freedom from Distractibility | | | |
| Anglo | 47.013 | 41 | 0.23981 |
| Hispanic | 75.637 | 41 | <0.001 |
| American Indian | 63.563 | 41 | 0.01347 |
| Two Factors: Verbal and Performance | | | |
| Anglo | 50.870 | 43 | 0.19140 |
| Hispanic | 83.955 | 43 | 0.00279 |
| American Indian | 73.162 | 43 | <0.001 |

Table 19 lists the equations used in the confirmatory factor analysis for each variable. When constraints were imposed, Factor 1 consisted of Information, Similarities, Vocabulary, Comprehension, and Digit Span. Factor 2 was comprised of Picture Completion, Picture Arrangement, Block Design, and Object Assembly. Factor 3 was composed of Arithmetic and Coding. Constraints were imposed upon the data in this order: Similarities, Comprehension, Information, Vocabulary, Object Assembly, Block Design, Digit Span, Picture Completion, Picture Arrangement, Arithmetic, and Coding.

The goodness-of-fit statistics are reported in Table 20. The fit of two different factor structures among the groups was analyzed: (1) a hypothesized factor structure and (2) Kaufman's (1975) three-factor solution. The best fit for the hypothesized factor solution was between the Anglo and American Indian groups with a chi-square of 84.56 and a probability of .67. The structure also fit between the Anglo and Hispanic subjects and across all three groups. The chi-square of 108.80 and probability level of .098 for the fit between the Hispanic and American Indian subjects approached acceptability. Results of the confirmatory factor analysis for Kaufman's (1975) three-factor model were similar to the results of the hypothesized model. Factor structures fit between groups for this model with the

Table 19

Factor Loadings of Individual Subtests

| | | | |
|---|---|---|---|
| Information | = *f1 | + *f3 | + e1 |
| Similarities | = *f1 | | + e2 |
| Arithmetic | = *f1 | + *f3 | + e3 |
| Vocabulary | = *f1 | | + e4 |
| Comprehension | = *f1 | | + e5 |
| Digit Span | = *f1 | | + e6 |
| Picture Completion | = *f2 | | + e7 |
| Picture Arrangement | = *f2 | | + e8 |
| Block Design | = *f1 + *f2 | | + e9 |
| Object Assembly | = *f2 | | + e10 |
| Coding | = *f1 | + *f3 | + e11 |

* = variables allowed to covary freely

Table 20

Goodness-of-Fit Statistics for Hypothesized Model

| | Chi-Square | df | Probability |
|---|---|---|---|
| Anglo-Hispanic | 97.013 | 91 | 0.31369 |
| Anglo-Indian | 84.556 | 91 | 0.66992 |
| Indian-Hispanic | 108.805 | 91 | 0.09834 |
| All three groups | 148.814 | 142 | 0.33090 |
| All three groups* | 134.390 | 120 | 0.17444 |

* = separate parameter estimates

Goodness-of-Fit Statistics for Verbal Comprehension, Organization, and Freedom from Distractibility Model

| | Chi-Square | df | Probability |
|---|---|---|---|
| Anglo-Hispanic | 128.172 | 99 | 0.02589 |
| Anglo-Indian | 108.339 | 99 | 0.24480 |
| Indian-Hispanic | 101.625 | 93 | 0.25387 |
| All three groups | 143.168 | 145 | 0.52745 |

exception of the Anglo-Hispanic comparison. The resulting chi-square was 128.17, and the probability level was .026. The fit for all three groups was strong with a chi-square of 143.17 and a probability of .527.

## Summary

This chapter was a presentation of the results of an analysis of WISC-R scoring patterns for referred Anglo, Hispanic, and American Indian children. The first investigation examined Verbal and Performance Scale mean score differences. Differences between the Verbal and Performance scores were not significant for the Anglo group, while they were for the Hispanic and American Indian groups.

The second investigation used exploratory factor analysis to extract the underlying factor structure for each group. Using the rule of eigenvalue greater than or equal to one and common factors, the Anglo group demonstrated the three-factor structure found by Kaufman (1975) and Silverstein (1977). Three factors were extracted for the Hispanic subjects. The common Verbal subtests loaded on Factor 1: Information, Similarities, Vocabulary, Comprehension, and Digit Span. Block Design and Object Assembly loaded on Factor 2, while Arithmetic, Picture Completion and Picture Arrangement loaded on Factor 3. Digit Span was the only subtest loading on Factor 4, therefore this is not a true factor, and a three factor

criteria was imposed on the principal-factor analysis. Three factors resulted in a six Verbal subtests loading on Factor 1; Block Design and Object Assembly loading on Factor 2; and Picture Completion, Picture Arrangement, and Coding loading on Factor 3. Three factors were extracted for the American Indian students. The first five Verbal subtests loaded on Factor 1 and Digit Span loaded highly on Factor 3. Picture Arrangement also loaded on Factor 1. Picture Completion, Block Design, and Object Assembly loaded on Factor 2. Factor 3 consisted of Arithmetic, Digit Span, and Coding. The cumulative percentage of variance ranged from 59.6% for the Anglo group to 69.3% for the Hispanic group.

The third method of analysis, confirmatory factor analysis, tested the fit for factor structures across and between the three groups. The strongest fit for factor structures was between the Anglo and American Indian subjects. The poorest fit was between the American Indian and Hispanic groups. Kaufman's (1975) three-factor structure did not fit between the Anglo and Hispanic subjects.

# CHAPTER 5

# DISCUSSION

The current investigation was designed to evaluate WISC-R performance patterns among Anglo, Hispanic, and American Indian children. Specifically, Verbal-Performance Scale discrepancies were examined, an exploratory factor analysis extracted the underlying factor structure for the three groups, and a confirmatory factor analysis of two- and three-factor structures was performed. The WISC-R was individually administered to elementary school children who were referred for a psychoeducational evaluation based on academic difficulties, or were due for a three-year reevaluation because they had previously been placed in the learning-disability program. The results are discussed in this chapter.

## Verbal-Performance Score Discrepancies

Examination of mean score differences between the Verbal and Performance scores revealed that each group scored higher on the Performance subtests than on the Verbal subtests. All three groups obtained Performance scores which clustered around 100. For the American Indian and Hispanic groups, a 15-point difference between Performance and Verbal means was found. The Anglo group had the smallest mean difference (6.31), while the Hispanic, and

American Indian students each obtained significant ($p < 0.01$) Verbal-Performance discrepancies of 15 points (one standard deviation). The Performance scores were within the average range for all three groups. These results concur with research previously cited in this study (Fourquean, 1987; Hynd et al., 1979; McShane, 1980; Palmer, et al., 1989).

Means based on a three-factor solution (Verbal Comprehension, Perceptual Organization, and Freedom from Distractibility) were computed for all three groups. All groups obtained their highest mean score on the Perceptual Organization factor, ranging from 10.10 to 10.40. The means for the Anglo group were approximately one point different in this descending order: Perceptual Organization, Verbal Comprehension, and Freedom from Distractibility. Minor differences were noted between the Hispanic and American Indian mean scores for the three factors. Mean scores for the Perceptual Organization factor were approximately three points higher than the obtained means for Verbal Comprehension and Freedom from Distractibility factors.

Individual subtests were examined for scoring pattern similarities among the three groups. The American Indian and Hispanic groups obtained their lowest Verbal subtest scores on Information, Digit Span, Arithmetic, and Vocabulary. The Anglo students scored higher on Vocabulary

than on Coding. Similarities, Coding, and Comprehension comprised the next highest scoring group. The highest scores for all three groups were on Object Assembly, Picture Arrangement, Picture Completion, and Block Design.

McShane (1980) summarized the ranking patterns of data from 12 studies of American Indian students. He found that these children scored highest on Mazes, Block Design, Object Assembly, and Picture Completion. Scores were not as high on Picture Arrangement and Digit Span. Next in ranking were Similarities, Comprehension, Information, and Arithmetic. The lowest scores were on Vocabulary. Coding was not reported. The American Indian children in this study scored somewhat differently. The highest scores were on Object Assembly, Picture Arrangement, and Picture Completion. Next highest scores were on Block Design and Similarities. Next in ranking were Coding, Comprehension, Vocabulary, Arithmetic, and Digit Span. The students scored lowest on Information.

There may be many reasons for the significant differences in the Verbal-Performance Scale scores. The purpose of the two scales was to measure verbal and nonverbal intelligence. True Verbal-Performance discrepancies may indicate that a child is more adept at processing nonverbal or visual-spatial stimuli, which is a right-hemisphere process. The left hemisphere is said

to process linguistic stimuli (Kaufman, 1979). McShane (1980) suggested that American Indian children may have highly developed visual-spatial abilities. As cited in Kaufman (1979), another interpretation of Verbal-Performance discrepancies is that they measure fluid and crystallized abilities. According to this theory, significantly higher Performance scores indicate an adaptable, flexible problem solving approach to new stimuli. Crystallized ability is dependent upon acculturation, education, and previous training (Kaufman, 1979). Children with psycholinguistic problems in one or more of the major modalities may demonstrate such severe discrepancies. The WISC-R requires the use of auditory-verbal and visual-motor channels. Many learning-disabled and American Indian children have had a medical history of otitis media, which can negatively affect language development. Children for whom English is a second language typically score in the average range on the Performance subtests and significantly lower on the Verbal subtests. Some of the Hispanic and American Indian children in this study may have had a primary language other than English. In some families in which English was a second language for the parents, English may not have been modeled well in the home. These children often develop poor English language skills, negatively impacting scores on verbally loaded tests. According to

Kaufman (1979), socioeconomic status can affect scoring patterns on the WISC-R. Children from professional families tend to score higher on the Verbal section than children of unskilled workers.

## Exploratory Factor Analysis

Exploratory factor analysis for the Anglo group resulted in the extraction of the classic three factor solution described by Kaufman (1975) and Silverstein (1977): Verbal Comprehension, Perceptual Organization, and Freedom from Distractibility. The Freedom from Distractibility Factor was present for the American Indian subjects, but not the Hispanic subjects.

Three factors were extracted for the American Indian students. The Verbal subtests, Information, Similarities, Arithmetic, Vocabulary, and Comprehension, loaded very significantly on Factor 1, indicating that this is a strong verbal factor for these learning-disabled Native American children. Picture Arrangement also loaded on Factor 1. According to Kaufman (1979), Picture Arrangement is a secondary measurement of Verbal Comprehension since the subject is required to arrange pictures to tell a story. This factor must be interpreted with caution. It appears to be a good measure of verbal ability or English language acquisition; however, interpretation of this factor as a measure of intelligence would be inappropriate as there are

mitigating elements which must be considered. The second factor which includes Picture Completion, Block Design, and Object Assembly appears to be a measure of perceptual organization. This scoring pattern was similar to that of the Anglo students, except that Picture Arrangement loaded on Factor 2 for the Anglos. The third factor consisted of the Freedom from Distractibility subtests: Arithmetic, Digit Span, and Coding. This factor was also found with the Anglo students; however, the subtest loadings were higher for the American Indian students. Previous research with Native American students did not reveal the Freedom from Distractibility factor.

Four factors were extracted for the Hispanic group. The first factor, a strong Verbal Comprehension factor with loadings of .67 or greater, was similar to that of the Anglo and American Indian subjects: Information, Similarities, Vocabulary, and Comprehension. The second factor appeared to be a visual-motor factor which included Block Design and Object Assembly. Factor 3 included Arithmetic, Picture Completion and Picture Arrangement and appeared to be a visualization factor. Digit Span alone loaded on Factor 4, thus it is not a true factor according to the common factor criteria of two or more subtest loadings on a factor. Coding did not load significantly on any factor.

When a criteria of three factors was imposed upon the Hispanic subjects, scoring patterns were very similar to the Anglo group, including Arithmetic and Digit Span on the first factor. The second factor remained a visual-motor factor with Block Design and Object Assembly. The third factor also remained a visualization factor with Picture Completion and Picture Arrangement. Coding (.22) loaded very weakly on this factor.

A Verbal Comprehension factor including Information, Similarities, Vocabulary, and Comprehension, was very clear for all three groups. All loadings of these subtests on the Factor 1 were .50 or greater. A Perceptual Organization factor including Picture Completion, Block Design, and Object Assembly, was also very clear for the Anglo and Native American students. Perceptual tasks seemed to be more delineated for the Hispanic students who had with a visual-motor factor (Object Assembly and Block Design) and a visualization factor (Picture Completion and Picture Arrangement). The lack of a clear Freedom from Distractibility factor for the Hispanic subjects concurs with previous research (Gutkin & Reynolds, 1980).

## Confirmatory Factor Analysis

Results of the confirmatory factor analysis of the hypothesized model indicated that the scoring patterns between American Indian and Anglo, and Hispanic and Anglo

children were similar. The most significant difference was between the scoring patterns of the American Indian and Hispanic children. This may be indicative of differences in cognitive processing between the two groups. An examination of the exploratory factor analysis indicated that the Perceptual Organization factor was not as clear for the Hispanic children as for the American Indian and Anglo children.

The confirmatory factor analysis using Kaufman's (1975) three-factor model indicated strong relationships between Anglo and American Indian, and American Indian and Hispanic scoring patterns. The weakest relationship was between Anglo and Hispanic children. It appears that a three-factor solution for these Hispanic children is not appropriate and that, as discussed in Chapter 2, different elements are affecting test score patterns for the Hispanic and American Indian children.

# CHAPTER 6

## SUMMARY

There are no simple solutions to the problematic issues encountered in studies of ethical assessment of minority children. For many of these children, intellectual assessment is an essential element of recommendations for placement in the most appropriate learning environment (Dana, 1984). Ideally financial and personnel resources would be available to provide dual learning environments: one to prepare students for integration and competition in the mainstream culture and one to preserve cultural and linguistic traditions.

### Implication

It is imperative that psychologists assessing minority children employ ethical practices. Circumspect evaluation of a child's cultural and linguistic milieu will help to avert inappropriate educational diagnoses of minority students. Verbal subtests may measure aptitude for performance in a conventional English language classroom rather than intelligence. Discrepancies between the Verbal and Performance Scales may indicate the degree of a student's acculturation. Performance subtest scores may provide an estimate for intelligence; however, visual, auditory, or motor deficits may negatively affect scores.

Full Scale scores are not an appropriate measure of intelligence since cultural and linguistic factors may depress the Verbal Scale and these scores should not be reported. The three factors found by Kaufman (1975) do not appear to be appropriate for all minority children and should not be used for WISC-R interpretation. Bannatyne's (1974) recategorized scores for a learning-disabled pattern do not seem to be appropriate for American Indian children. The typical Native American pattern of Spatial -> Sequential -> Conceptual -> Acquired Knowledge (McShane & Plas, 1982c) should only be used when assessing children from traditional Native American environments and not for diagnosing learning-disabilities. Psychologists should construct meaningful diagnostic interpretations for teachers. Academic difficulties for many minority children are compounded by learning environments requiring verbal facilities. Teaching techniques emphasizing flexible and creative problem solving will aid in providing a more successful learning environment for these children.

## Future Trends

Many questions concerning the interpretation of the Wechsler (1974) Scales for minority children remain unanswered. Research investigating test validity and the etiology of the scoring differences must continue with the WISC III. Psychologists must meaningfully interpret these

scales so that classroom teachers can tap into the full potential of all children. Cross-tribal studies as well as studies of traditional and acculturated children will help to present a more integrated picture of Native American performance patterns. Implementation of cross-cultural studies of children who have not been referred for a psychoeducational evaluation would help delineate issues of cultural effects on scoring patterns. To address validity concerns of using intelligence tests with minority children, alternative measures, such as neuropsychological evaluations, should be considered in the identification process.

A major deficiency in cross-cultural education is that school systems are based on the cultural mores of the majority, while many cross-cultural students have differing lifestyles, values, and goals (Dana, 1984). Too often cultural practices are misunderstood and misinterpreted. Most school psychologists are involved with culturally diverse children. Consequently, all psychologists have an ethical obligation to be aware of the current literature addressing cross-cultural issues and to effect cultural sensitivity through staffings, consultations, and inservices. Cultural awareness enables individuals to suspend themselves from their own cultural expectations and beliefs, while cultural ignorance perpetuates the system of

ethnocentricity. "Ultimately what is required is a change in attitude toward culturally different persons that legitimatize their construction of reality and honors their human condition." (Dana, 1984).

If we are truly committed to the democratic ideal of equal opportunity for all people, continued research is paramount.

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