Factor Analysis of the Spanish Version of the WAIS: The Escala de Inteligencia Wechsler para Adultos (EIWA)

Francisco C. Gómez, Jr.
Boston University and
Dr. Solomon Carter Fuller Mental Health Center

Ralph L. Piedmont
Towson State University

Michael Z. Fleming
Dr. Solomon Carter Fuller Mental Health Center
and Boston University

The standardization of the Escala de Inteligencia Wechsler para Adultos (EIWA) and the original Wechsler Adult Intelligence Scale (WAIS) were subjected to principal-components analysis to examine their comparability. The robustness of the overall intelligence dimension for the EIWA was supported. A 2-factor solution provided a clear interpretable structure representing the Verbal and Performance scales. A 3-factor solution was not seen as interpretively or statistically viable. Congruence coefficients were .99 for a single factor and .96 and .97 for 2 factors. The similarity of the EIWA and WAIS factor structure was supported. Clinical implications are discussed.

Hispanics constitute the largest linguistic minority group in the United States, but research examining the integrity of psychological instruments for Spanish-speaking populations has largely been ignored. The 1989 US census estimated the Hispanic population at 20,076 million, an increase of 38.9% over 1980, the largest for any ethnic group (Schick & Schick, 1991). Thus, an urgent need exists for psychological instruments that address this much-neglected burgeoning population. A review of the literature concerning Hispanics reveals that most of the research pertains to children (McShane & Cook, 1985); research on adults is virtually nonexistent. One of the most widely used instruments in psychological, educational, and research settings is the Wechsler Adult Intelligence Scale (WAIS; Wechsler, 1955) and its revision, the WAIS-R (Lubin, Larsen, Matarazzo, & Seever, 1985; Wechsler, 1981). A Spanish version of the WAIS exists, the Escala de Inteligencia Wechsler para Adultos (EIWA; Wechsler, 1968), but it has received little attention.

Structurally, the EIWA is patterned after the WAIS. It contains 11 subtests, but many were changed to make them suitable to Spanish-speaking respondents (in this case, Puerto Rican). For example, the Information subtest question that asks the respondent to name four presidents since 1950 was changed to one that asks the respondent to name the three languages spoken in Latin America. The reliability coefficients of the Verbal, Performance, and Full Scale IQs are comparable to the WAIS:

.65 to .96 for subtest scores and .95, .97, and .98 for the Performance, Verbal, and Full Scale IQs, respectively. Although intuitively it might seem that Puerto Rican norms differ from Mexican-American, Cuban, or Guatemalan norms, this has yet to be investigated. However, it is common to administer the EIWA to any Spanish-speaking person, a practice that may be dubious but necessary.

Numerous studies, using diverse samples and a variety of factor-analytic techniques, have examined the factor structure of the WAIS and the WAIS-R. In general, Cohen's (1957) tripartite structure—verbal, performance, and “memory efficiency” or “freedom from distractibility”—and Wechsler's (Matarazzo, 1972) dichotomy of verbal and performance have emerged as the preferred solutions. Some researchers favor a two-factor solution and others a three-factor solution; however, the issue seems to be one of preference, factor order, degree of complexity, or level of analysis, and neither can be said to be correct or incorrect on mathematical grounds alone. Among this multitude of research and controversy, there exists to date only one factor-analytic English-language publication on the EIWA. Kuncel and Schmidt de Vales (1986) derived the factor structure for a sample of Mexican psychiatric patients, but their study involved some serious limitations. Specifically, the authors did not state the factor-analytic method they used, claimed to account for 100% of the variance with three factors, did not report their rationale for extracting factors, and were unclear about the identity of their sample, referring to them at times as psychiatric patients and at times as Mexico City workers. The lack of both conceptual and statistical clarity leads one to readily dismiss this study.

A search of English-language journals identified only three other empirical studies examining the EIWA (Davis & Rodriguez, 1979; S. López & Romero, 1988; L. R. López & Taussig, 1991). Davis and Rodriguez (1979) compared the Block Design and Vocabulary subtests of the EIWA and WAIS in a repeated

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Correspondence concerning this article should be addressed to Francisco C. Gómez, Jr., Boston University, Department of Psychology, 64 Cummingston Street, Boston, Massachusetts 02215.
measures design using a bilingual Latin American psychiatric population. They found that scores differed significantly enough to seriously question the comparability of both tests. These results can, at best, be viewed as preliminary considering their very small sample size. S. López and Romero (1988) examined the comparability of the WAIS and EIWA and found that there were differences in the subtest items (only 43% of the items were identical), excluding the Digit Symbol subtest. In addition, differences were also found in the administration, content, and assignment of scores for all subtests except Digit Span and Object Assembly. Finally, L. R. López and Taussig (1991) examined whether the EIWA overestimates or the WAIS-R underestimates the cognitive functioning of a Spanish-speaking elderly Alzheimer dementia and non-Alzheimer dementia sample. They examined raw and scale scores for EIWA-WAIS-R Similarities and Vocabulary subtests. Their findings indicate that the EIWA is appropriate with a lower educated sample of monolingual Spanish speakers and inappropriate with a population that is highly educated, that is fluent in English, and that ranks high in job status. However, the authors expressed caution in generalizing their findings when considering their specific sample (elderly) and use of only 2 of 11 EIWA-WAIS-R subtests.

Given the significant number of changes in the Spanish version of the WAIS and the absolute dearth of empirical documentation evaluating this instrument, there exists a clear need for basic, exploratory research. The present report will attempt to fill this vacuum by first factor analyzing data obtained from

Table 1

<table>
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</table>

Note. EIWA = Escala de inteligencia Wechsler para Adultos.

Table 2

<table>
<thead>
<tr>
<th>Scale</th>
<th>One factor</th>
<th>Two factors</th>
<th>Three factors</th>
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<td>One</td>
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<td>Information</td>
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<tr>
<td>Vocabulary</td>
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<td>Eigenvalue</td>
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<td>7.2</td>
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<td>% total variance</td>
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<td>66.0</td>
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Note. EIWA = Escala de inteligencia Wechsler para Adultos. Factors were obtained using a principal-components method of extraction with an oblique rotation.
the EIWA standardization sample and then comparing these
various factor solutions with similar ones obtained from the
WAIS standardization sample to better determine the degree of
comparability between the two instruments.

Method

The data for this study were taken from the EIWA and WAIS man-
uals. Scale intercorrelations are given for only three age groups for both
the EIWA (6–19 years, n = 236; 25–34 years, n = 224; and 45–54 years,
n = 156) and WAIS (18–19 years, n = 200; 25–34 years, n = 300; and
45–54 years, n = 300) because Wechsler saw these groups as being
representative of the entire sample. An overall correlation matrix was
constructed from the EIWA tables and is presented in Table 1.

The values in this matrix were determined by transforming the in-
terscale correlations in each of the age groups into a z score, weighting
by sample size, and then aggregating. The resulting z scores were then
converted back into correlations. This matrix was then subjected to a
principal-components analysis with unities on the diagonal. One,
two-, and three-factor solutions were extracted and obliquely rotated.
Although varimax rotations have been the preferred method in these
circumstances (Hill, Reddon, & Jackson, 1985), there are both tech-
nical and theoretical reasons that argue against such an approach. First,
there is no reason to assume that intellectual abilities represent inde-
pendent entities. No theory of intelligence suggests one set of abilities
to be distinct from any other set. Second, whereas varimax rotations are
used to approximate simple structure in the data, an examination
of the results of such analyses with the WAIS usually shows considerable
nonzero loadings of the subscales (e.g., above .2) on the nondomi-
nant factors (e.g., Atkinson & Cyn, 1984; Beck, Horwitz, Sidesberg,
Parker, & Frank, 1985; Ryan, Rosenberg, & DeWolfe, 1984). There is
evidence that oblique solutions provide better fits to WAIS data (e.g.,

A similar interscale correlation matrix was also calculated from the
WAIS standardization data. Using the data presented in Tables 7, 8,
and 9 of the manual (Wechsler, 1955), overall correlations were deter-
mained in a manner identical to that used with the EIWA. This matrix
was also factor analyzed, and one-, two-, and three-factor solutions
were produced. The weights from these solutions were compared with
the weights derived from similar EIWA solutions to determine the
factor comparability of the two instruments.

Results

Table 2 provides the factor loadings for the three EIWA solu-
tions. As can be seen, the first factor emerges with an eigen-
value of 7.2 and accounts for 66% of the total variance. With no
subtest loading less than .74, this factor clearly represents “g.”
When a second factor is extracted, it accounts for only 6% of the
total variance and has an eigenvalue less than unity. Interpre-
tively, this solution clearly represents the Verbal and Performance
dimensions of the EIWA. However, Digit Symbol retains a
significant presence on both dimensions. Although not indi-
cated by either a scree test or by the eigenvalue greater than one
criterion, a three-factor solution resembles the familiar tripart-
tite scheme of Verbal Comprehension, Perceptual Organization,
and Freedom from Distraction initially proposed by Co-
en (1952). However, there does exist some interpretive ambigu-
ity, aside from the high loadings for Arithmetic and Digit Span,
there are significant secondary loadings for Digit Symbol
(which loads on all three factors) and Block Design. From a
purely statistical perspective, the one-factor model fits the data
best, although a two-factor solution is interpretively appro-
riate. Extracting more than two factors results in dimensions
that are both interpretively curious and account for little addi-
tional variance.1

Table 3
Convergence Coefficients Between Comparable EIWA
and WAIS Factor Solutions

<table>
<thead>
<tr>
<th>WAIS</th>
<th>One factor</th>
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<th>Three factors</th>
</tr>
</thead>
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<tr>
<td>One factor</td>
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<td>.96</td>
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<td>Two factors</td>
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<td></td>
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<tr>
<td>Three factors</td>
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<td></td>
</tr>
<tr>
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<td>.96</td>
<td>.92</td>
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</tr>
<tr>
<td>3</td>
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</table>

Note. EIWA = Escala de Inteligencia Wechsler para Adultos. WAIS =
Wechsler Adult Intelligence Scale.

Table 4
Mean Variance Components for the EIWA
Over Three Age Groups

<table>
<thead>
<tr>
<th>Scale</th>
<th>Reliability</th>
<th>Common</th>
<th>Specific</th>
<th>Error</th>
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<td>Comprehension</td>
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</table>

Note. EIWA = Escala de Inteligencia Wechsler para Adultos.

1 Two additional factor analyses were conducted. The first used a
principal-axis factor procedure with an oblique solution. The results of
this analysis were virtually identical to the results of the ones pre-
ned; thus, the results presented here involve principal-components
analysis using a varimax rotation. These results, although showing a
similar pattern as presented in Table 2, did not evidence good simple
structure. In the two-factor solution, loadings on the first factor ranged
from .28 to .58, and loadings on the second factor ranged from .28 to
.45. For the three-factor solution, loadings on the nondominant scales
ranged from .20 to .46. From an interpretive perspective, the use of
To determine the degree of factor comparability between the EIVA and the WAIS, congruence coefficients (Wrigley & Neuhau, 1955) were calculated for each set of factor solutions. The results are presented in Table 3. As can be seen, there is a very high degree of similarity between comparable EIVA and WAIS solutions. Thus, despite the many changes necessitated by the translation of the WAIS to Spanish, the underlying structure of the new instrument remains virtually identical to its parent, regardless of the factor solution.

The total variance of a subtest score can be divided into three components: variance common with the other subtests, variance specific to the subtest in question, and error variance. Table 4 provides estimates for each of these components that are aggregated over the three age groups. The common variance represents the squared multiple (adjusted) correlation of each subtest with the remaining subtests. Specific variance was obtained by subtracting the common variance from the reliability of the scale, as reported in Table 6 of the EIVA manual. Finally, the error variance was obtained by subtracting the reliability from unity; the total variance. The simple averages of the three variance components, across age groups, are shown in Table 4.

Ideally, the common variance should exceed both the specific variance and the error variance, in that order. Silverstein (1982), who analyzed the WAIS and WAIS-R in this manner, suggested that for a subtest to warrant specific interpretation, the specific variance should be greater than the error variance and should also account for at least one quarter of the total variance. Using these criteria, the Arithmetic, Similarities, and Block Design scales all warrant specific interpretations. The pattern of findings presented here closely resembles Silverstein’s findings for the WAIS. Thus, some inter-scale comparisons used with the WAIS for interpretive purposes can also be appropriately applied to EIVA inter-scale scores.

**Discussion**

These analyses show that the EIVA has, essentially, one underlying dimension that represents 66% of the total variance. Thus, one could argue that interpretation of EIVA performance should be limited to the Full Scale IQ only. Despite the overwhelming presence of this general dimension, extracting an additional factor provides a clear interpretive structure that represents the Verbal and Performance scales. The three-factor solution is statistically less compelling and interpretively more ambiguous and should not be, given these data, the preferred solution. The tenuousness of the three-factor solution has also been noted with the WAIS-R (e.g., Piedmont et al., 1991).

Given the relatively small normative sample size and its lack of representativeness (Puerto Ricans only), further research that includes a more heterogeneous Hispanic sample is needed to provide a better estimate of the EIVA factor structure. Yet, despite these limitations and the very real concerns that arise when an instrument is translated into another language (e.g., in the case of the EIVA, some of the original WAIS items were dropped and new ones were added; in fact, some of the EIVA scales have only a small item overlap with the WAIS), it is remarkable that the EIVA, at least structurally, emerges as a psychometric reflection of the WAIS. To be cautiously optimistic, the possibility may exist for generalization research done on the WAIS to include the EIVA. This may help tentatively fill some interpretive gaps.

Of course, further work needs to be done that focuses on the cognitive abilities captured by each subscale. This would provide direct evidence of the interpretive comparability between the two instruments. Nonetheless, researchers and clinicians can have a degree of confidence in the EIVA as a measure of intellectual dimensions similar to the WAIS. This has particular relevance for neuropsychological testing, in which interest scatter is more important than actual full scale scores. We hope that further research will be directed at addressing norms and validity markers for the EIVA to make clear the strengths and weaknesses of the instrument.

**References**


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