Abstract
The interpretation of the French Wechsler Intelligence Scale for Children-Fifth Edition (WISC-V) is based on a 5-factor model with Verbal Comprehension (VC), Visual Spatial (VS), Fluid Reasoning (FR), Working Memory (WM), and Processing Speed (PS). Evidence of the factorial structure of the French WISC-V was established only through Confirmatory Factor Analyses (CFAs). However, as suggested by several authors, factorial structure should derive from both Exploratory Factor Analysis (EFAs) and CFAs. The first goal of this study was to examine the factorial structure of the French WISC-V with EFAs for five age groups: 6-7, 8-9, 10-11, 12-13, and 14-16 years. For age groups, the WISC-V inter-correlation matrix for the 15 subtests scores was used. Factor extraction criteria (MPA, HPA, BIC, SABIC, etc.) suggested that 1 factor should be retained for age groups 8-9 and 10-11, 2 factors for age group 12-13, and 3 factors for age groups 6-7 and 14-16. None criteria supported a five first-order factors model for these five age groups. To disentangle the contribution of 1st and 2nd order factors, the Schmid and Leiman [...]
INTRODUCTION

- Interpretation of the French Wechsler Intelligence Scale for Children-Fifth Edition (WISC-V) is based on a 5-factor higher-order model including Verbal Comprehension (VC), Visual Spatial (VS), Fluid Reasoning (FR), Working Memory (WM), and Processing Speed (PS).
- In the preferred publisher model, there are three cross-loadings of the Arithmetic subtest on VC, FR, and WM; all other 14 subtests are associated with only one latent variable.
- Evidence of this factorial structure was established through Confirmatory Factor Analyses (CFA); no Exploratory Factor Analysis (EFA) were reported.
- Publishers indicated that this model was satisfactory for all age groups (6-7, 8-9, 10-11, 12-13, and 14-16 years); however, no detailed EFAs and CFAs were reported in the French technical manual.

OBJECTIVE

- The present study addressed 3 goals:
  1. The first goal was to estimate the number of factors in each age group (6-7, 8-9, 10-11, 12-13, and 14-16 years).
  2. The second goal was to estimate the relationship between every latent variable and subtest score, and to estimate the proportion of variance explained by the general factor.
  3. The third goal was to replicate and extend the CFAs for each age group.

METHOD

- Sample:
  - Publisher refused to provide standardization raw data for independent analyses so variance-covariance matrices reproduced using correlation matrices and descriptive statistics from manual.
  - The French standardization sample included 1049 children who were divided by age into 11 groups, each consisting of 80 - 104 children.
  - The WISC-V inter-correlation matrices for the 15 subtests scores were used for 5 age groups: 6-7, 8-9, 10-11, 12-13, and 14-16 years.
  - Publisher refused to provide standardization raw data for every latent variable and subtest score, and to estimate general intelligence variance thus may be of questionable utility.
- Material:
  - The 15 subtests scores were used (here with the preferred factorial structure proposed by the publisher; with 3 cross-loadings).

RESULTS

2) Relationships between latent variables and subtest scores:
- We used the R-package “OmegaSem,” which do an EFA, take the highest loading items on each score, and then do a CFA. OmegaSem estimates $g_{h}$, an indicator of the general factor saturation.
- 1. Bifactor structure, no specification of the number of factors

<table>
<thead>
<tr>
<th>ECV of g</th>
<th>g loading</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-7 years</td>
<td>0.70</td>
<td>.26 (CA) -.76 (AR)</td>
<td>SI-VO-IN-CO</td>
<td>BD-VP-MR</td>
</tr>
<tr>
<td>8-9 years</td>
<td>0.71</td>
<td>.33 (CD) -.72 (IH)</td>
<td>SI-VO-IN-CO</td>
<td>BD-VP-MR</td>
</tr>
<tr>
<td>10-11 years</td>
<td>0.73</td>
<td>.27 (CA) -.74 (VP)</td>
<td>SI-VO-IN-CO</td>
<td>BD-VP-MR</td>
</tr>
<tr>
<td>12-13 years</td>
<td>0.65</td>
<td>.27 (CD) -.85 (VP)</td>
<td>SI-VO-IN-CO</td>
<td>DS-CN-PA</td>
</tr>
<tr>
<td>14-16 years</td>
<td>0.70</td>
<td>.27 (CD) -.85 (VP)</td>
<td>SI-VO-IN-CO</td>
<td>DS-CN-PA</td>
</tr>
</tbody>
</table>

3) Confirmatory factor analyses (model 5e, and 5c)

<table>
<thead>
<tr>
<th>AR: VC-WM: FR</th>
<th>CFI</th>
<th>TLI</th>
<th>RMSEA</th>
<th>SRMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-7 years</td>
<td>.938</td>
<td>.917</td>
<td>.069</td>
<td>.050</td>
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<tr>
<td>8-9 years</td>
<td>.979</td>
<td>.972</td>
<td>.040</td>
<td>.043</td>
</tr>
<tr>
<td>10-11 years</td>
<td>.965</td>
<td>.953</td>
<td>.055</td>
<td>.046</td>
</tr>
<tr>
<td>12-13 years</td>
<td>.915</td>
<td>.885</td>
<td>.088</td>
<td>.057</td>
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<tr>
<td>14-16 years</td>
<td>.966</td>
<td>.954</td>
<td>.055</td>
<td>.045</td>
</tr>
</tbody>
</table>

- Although global fit indices were adequate for each age group, local fit assessment of the publisher preferred model suggested it was not adequate: Arithmetic does not measure VC.

CONCLUSIONS

1. Factor extraction criteria suggested to retain only 3 factors. Analyses with OmegaSem support this hypothesis. No EFA evidence for 5 factors was found.
2. The Schmid-Leiman orthogonalization transformation showed that:
   - The g factor was the predominate source of variation among subtests scores;
   - Loadings on the g factor were higher than loading on the specific first-order factors for all subtests scores except for CD, SS, and CA scores.
3. CFA analyses indicated that:
   - The preferred publisher model with 5-first order factors was not supported. Higher-order models with 4-first order factors were more adequate;
   - Bifactor model better fit the data than the higher-order model;
- We recommend users do not discount the Full Scale IQ when interpreting the index scores of the French WISC-V, because the general factor accounts for the bulk of the common variance in the French WISC-V. The 5 index scores correlate broad ability variance with general factor variance, thus are not pure measures of broad abilities. Evidence shows that French WISC-V index scores among 5 age groups are generally poor indicators of broad abilities when purged of general intelligence variance thus may be of questionable utility.