Exploratory Structural Equation Modelling (ESEM) of the French Wechsler Intelligence Scale for children-Fifth Edition (WISC-V)

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Abstract

Interpretation of the French Wechsler Intelligence Scale for Children–Fifth Edition (WISC–V) is based on a 5-factor model including Verbal Comprehension, Visual Spatial, Fluid Reasoning, Working Memory, and Processing Speed. Evidence of the factorial structure of the WISC–V was established through Confirmatory Factor Analyses (CFA). However, factorial structure should derive from both Exploratory Factor Analysis (EFAs) and CFAs. EFA has been recently integrated with CFA/SEM into the Exploratory Structural Equation Modelling (ESEM). The goal of this study was to examine the factorial structure of the French WISC–V with ESEM. The 15 French WISC–V primary and secondary subtest scaled scores inter-correlation matrix reported in the French technical manual was used. Bifactor-ESEM indicated that the better model included four-factor. Consistent with previous studies, findings suggested a general intelligence factor, with a verbal factor, a processing speed factor and a reasoning factor. No evidence for five factors was found.

Reference


Available at: http://archive-ouverte.unige.ch/unige:98492

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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 (CFAs) by the publisher; no Exploratory Factor Analyses (EFAs) were reported.
- To avoid some limitations of EFA and CFA, EFA has been recently integrated with CFA/SEM into the Exploratory Structural Equation Modeling (ESEM).

OBJECTIVE

- The present study addressed 2 goals:
  1. The first goal was to estimate the number of factors with EFA by using several criteria.
  2. The second goal was to conduct Exploratory Structural Equation Modeling (ESEM).

METHOD

- Sample:
  - Publisher refused to provide standardization raw data for independent analyses so variance-covariance matrix reproduced using correlation matrix 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 matrix for the 15 subtests scores were used (here with the preferred factorial structure proposed by the publisher).
- Material:
  - The 15 subtests scores were used (here with the preferred factorial structure proposed by the publisher).

RESULTS

1) Examination of criteria to determine the number of factors

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2) ESEM - Summary of model fit information

- 4-factor > 3-factor > 2-factor (orthogonal and oblique rotation)
- No convergence with 5, 6 or 7 factors

CONCLUSIONS

1. Factor extraction criteria suggested to retain between 2 and 4 factors. No EFA evidence for 5 factors was found.
2. Similar results with ESEM: 3 broad abilities factors and a general factor (with both orthogonal and oblique).
   - Broad abilities were: VC, PS, and a mixture of WM and VS
   - No evidence for distinct VS, FR and WM factors was found.
3. Also similar results with OmegaSEM: 3 broad factors and a general factor.

The g factor was the predominating 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.

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 conflate broad ability variance with general factor variance, thus are not pure measures of broad abilities. Evidence shows that French WISC-V index scores are generally poor indicators of broad abilities when purged of general intelligence variance thus may be of questionable utility.