

# **Validation of the Egyptian WAIS-IV: An IRT approach and Mokken scale analysis**

This thesis is presented by

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Submitted for the Degree of Doctor of Psychology with international mention

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Barcelona, 2021



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## ***Abstract***

***Background.*** The Wechsler Adult Intelligence Scale (WAIS) has been a key factor in assessing adult intelligence throughout the history of intelligence measures. The WAIS fourth-edition (WAIS-IV; Wechsler, 2008) is the latest version, which has several improvements compared to previous editions. The WAIS-IV was prepared initially for the US population and was adapted to 28 environments. Unfortunately, there is no version of the WAIS-IV for Arabic speakers. Moreover, no efforts – to my knowledge – have been found to adapt it to this population.

***Objectives.*** In this context, the current thesis sought to adapt and validate the WAIS-IV for Arabic speakers and assess its statistical properties using the item response theory (IRT) and the Mokken scaling analysis (MSA). These general objectives were operationalized into three consecutive specific objectives: I) adaptation and validation of the WAIS-IV in the population of Arabic speakers, especially for the Egyptian population, II) assessing the psychometric properties of the Egyptian WAIS-IV using nonparametric IRT models, III) investigating the measurement properties of the WAIS-IV using parametric IRT models.

***Method.*** The completion of three studies helps achieve these thesis objectives. The first study adapted the WAIS-IV subtests to Arabic speakers, carried out by a committee of field experts in the Arabic language, the English language and educational and psychological sciences. Except for one supplemental subtest (comprehension subtest), all subtests were translated and adapted to Arabic speakers. Furthermore, Study 1 investigated the structure of WAIS-IV with an Egyptian sample, which tested 17 models, including a one-factor structure, a two-factor structure, the four-factor structure suggested in the WAIS-IV manual and a modified four-factor structure and a five-factor structure according to the Cattell–Horn–Carroll theory. Studies 2 & 3 emerged from objectives II and III and investigated the psychometric properties of the Egyptian WAIS-IV subtests using MSA and parametric IRT in a sample of 250 adults between 18 and 25 years of age.

***Results.*** The findings of Study 1 revealed that, with the exception of two models (one factor and two-factor models), all suggested models fit with the Egyptian WAIS-IV data. When creating a path from the Arithmetic subtest to perceptual reasoning and working memory, the modified four first-order factor model fits better. Moreover, the WAIS-IV scale and the four-factor using alpha coefficient and omega coefficients ( $\omega$ ) had good reliability.

However, the values of  $\omega_h$  were low for the four-factor. Moreover, the reliability of each subtest of the Egyptian WAIS-IV was assessed using Molenaar-Sijtsma, Lambda-2, latent class reliability and Cronbach's alpha coefficients. The results imply that the Egyptian WAIS-IV subtests have good internal consistency.

The two nonparametric IRT (the monotone homogeneity model and the double monotonicity model) based on the MSA fitted the Egyptian WAIS-IV data (i.e. study 2). According to the MSA results, the Egyptian WAIS-IV subtests seem to be hierarchical scales. Consequently, each subtest is ordered in this way according to the mean score (i.e. difficulty). Additionally, subjects are done in this manner using sum scores as well. However, some items violated the invariant item ordering and scalability criteria.

Among a group of IRT models tested in study 3, the results revealed that the two-parameter logistic model (2PLM) showed a good fit for dichotomous subtests, whereas the graded response model (GRM) fitted the polytomous data of the Egyptian WAS-IV. Most items revealed high discrimination and the Egyptian WAIS-IV scale showed adequate information across the levels of cognitive variables measured. However, each subtest included at least some items with limited ability to distinguish between individuals with differing levels of cognitive variables. Contrary to expectations, studies 2 & 3 indicated that most subtests have items that do not follow the difficulty rank assigned in the WAIS-IV manual. Therefore, the current thesis proposed a new order for items of some subtests of the Egyptian WAIS-IV follow difficulty parameter or mean item scores.

**Conclusion.** Overall, this study's contribution is to adapt and validate the WAIS-IV with an Egyptian sample. The Egyptian WAIS-IV is a validated intelligence scale assessing Arabic adult speakers, especially for the Egyptian population. Unfortunately, the study did not include all countries with Arabic speakers and caution should be exercised when assessing the intelligence of Arabic speakers who are not Egyptian citizens.

**Keywords:** WAIS-IV, item difficulty, Mokken scaling analysis, item response theory, psychometric properties, test adaptation.