Revue européenne de psychologie appliquée 66 (2016) 101–107

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Original article

# WISC-IV GAI and CPI profiles in healthy children and children with learning disabilities

## *Profils des scores IAG et ICC du WISC-IV pour des enfants témoins et des enfants avec des troubles des apprentissages*

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ARTICLE INFO

*Article history:*
Received 16 December 2015
Received in revised form 21 March 2016
Accepted 8 April 2016

*Keywords:*
WISC-IV
GAI
CPI
Assessment
Base rate
Learning disability

ABSTRACT

*Introduction.* – In addition to the FSIQ, the General Ability Index (GAI) and the Cognitive Proficiency Index (CPI) are two ancillary scores that can be calculated for the Wechsler Intelligence Scale. The GAI and the CPI have been proposed to assist in identifying cognitive strengths and weaknesses, and thus to provide different views into individual's cognitive abilities.
*Objective.* – The purpose of the present study is to provide the frequency of GAI/CPI score difference by direction, the frequency of FSIQ/GAI score difference, and the frequency of FSIQ/CPI score difference, for the French Wechsler Intelligence Scale for Children and Adolescents–Fourth Edition (WISC-IV).
*Method.* – These frequencies are provided for a sample of healthy children ($n = 483$), and for a sample of children with learning disabilities (LD, $n = 370$). The GAI comprises verbal comprehension and perceptual reasoning subtests, while CPI comprises working memory and processing speed subtests.
*Results.* – Results indicated that the healthy sample performed better than the LD sample for all composite scores. The FSIQ was lower than the GAI for both groups and this difference was slightly larger for the LD sample (−1.35 points vs. −3.22 points). The GAI was higher than the CPI for both samples, but this difference was not significantly larger for the LD sample (4.2 points vs. 6.16 points). Finally, while the FSIQ was higher than the CPI for both groups, this difference was not larger for the LD sample (2.85 points vs. 2.95 points).
*Conclusion.* – These findings support the use of the GAI and the CPI, in addition to the FSIQ.


*Mots clés :*
WISC-IV
IAG
ICC
Évaluation
Fréquence d'apparition
Troubles des apprentissages

RÉSUMÉ

*Introduction.* – Il a été proposé dans les échelles d'intelligence de Wechsler de calculer l'Indice d'Aptitude Générale (IAG) et l'Indice de Compétence Cognitive (ICC), en complément du Quotient Intellectuel (QI). L'IAG et l'ICC doivent apporter des informations complémentaires sur le fonctionnement cognitif d'un individu, et doivent permettre d'identifier les « forces » et les « faiblesses » cognitives.
*Objectif.* – Le but de cette étude est de fournir les fréquences d'apparition des scores de différence entre l'IAG et l'ICC, entre le QI et l'IAG et entre le QI et l'ICC pour la version française de l'échelle d'intelligence de Wechsler pour enfants et adolescents (WISC-IV).
*Méthode.* – Les fréquences d'apparition des scores de différences sont calculées à partir d'un échantillon d'enfants « témoins » ($n = 483$), et à partir d'un échantillon d'enfants présentant des troubles spécifiques des apprentissages (LD, $n = 370$). L'IAG comprend les sous-tests de compréhension verbale et de raisonnement perceptif. L'ICC comprend les sous-tests de mémoire de travail et de vitesse de traitement.

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http://dx.doi.org/10.1016/j.erap.2016.04.001
1162-9088/

*Résultats.* – Pour tous les indices, les enfants témoins obtiennent de meilleures performances que les enfants avec des troubles des apprentissages (LD). Pour les 2 groupes, le QI conduit à des performances inférieures à l'IAG et cette différence est significativement plus importante pour les enfants LD (−1,35 points vs −3,22 points). Pour les 2 groupes, l'IAG conduit à de meilleures performances que l'ICC, mais cette différence n'est pas significativement plus importante pour les enfants LD (4,2 points vs 6,16 points). Enfin, pour les 2 groupes, le QI conduit à de meilleures performances que l'ICC, mais la différence entre les 2 groupes n'est pas significative (2,85 points vs 2,95 points).
*Conclusion.* – Globalement, ces données supportent l'utilisation des scores IAG et ICC en complément du QI.



## 1. Introduction

The Wechsler Intelligence Scale for Children–Fourth edition (WISC-IV) is administered in standardized ways by psychologists for estimating individuals' general cognitive ability, and is used for various purposes. For instance, the WISC-IV is used to determine if a cognitive disability underlies a child's school difficulty, or to predict a child's ability to benefit from special education placement. To deal with these goals, the current French version of the WISC (the WISC-IV[1]) distinguishes four index scores (Verbal Comprehension [VCI];Perceptual Reasoning [PRI];Working Memory [WMI]; and Processing Speed [PSI]; Weiss, Keith, Zhu, & Chen, 2013)[2]. In supplement to the Full Scale IQ (FSIQ), these indexes are used to help clinicians to understand the cognitive functioning of children. In addition, Weiss, Beal, Saklofske, Alloway, and Prifitera (2008) have suggested to use two additional composite scores: the General Ability Index (*GAI*) and the Cognitive Proficiency Index (CPI; Bremner, McTaggart, Saklofske, & Janzen, 2011; Kaufman, Raiford, & Coalson, 2016; Prifitera, Saklofske, & Weiss, 2005; Weiss, Saklofske, Coalson, & Raiford, 2010; Weiss, Saklofske, Holdnack, & Prifitera, 2016). Weiss, Beal et al. (2008, p. 9) assumed that the GAI and the CPI might "*contribute to diagnosis and intervention planning*". In the recent U.S. WISC-V, the GAI and the CPI are two ancillary indexes (Weiss et al., 2016).

The GAI is an estimate of general intellectual ability, that summarizes performance on the VCI and PRI subtest scores, and "is now fairly routinely used by clinicians for describing components of intellectual ability assessed using both the WISC-IV and WAIS-IV" (Saklofske et al., 2012, p. 117). By excluding the WMI and the PSI subtest scores, the GAI includes more highly "g" loaded subtest scores. Prifitera, Weiss, and Saklofske (1998) have initially developed the GAI for use with the WISC-III, because some children exhibit deficits in working memory and processing speed. Low performance on working memory and processing speed subtest scores lowers the FSIQ (Weiss, Saklofske, Prifitera, Chen, & Hildebrand, 1999). Thus, when there is some variability across the indexes, the GAI and the FSIQ can lead to different impressions of a child's cognitive functioning. Some years later, the GAI was developed for the Wechsler Adult Intelligence Scale–third edition (WAIS-III) by Tulsky, Saklofske, Wilkins, and Weiss (2001). Then, the GAI tables were developed for the U.S. WISC-IV (Raiford, Weiss, Rolfhus, & Coalson, 2005), the Canadian WISC-IV (Saklofske, Weiss et al., 2005) and the Canadian WAIS-III (Saklofske, Gorsuch, Weiss, Zhu, & Patterson, 2005). Regarding the French WISC-IV, Lecerf, Reverte, Coleaux, Favez, and Rossier (2010) have initially developed the GAI tables by using a statistical approximation procedure, on the basis of the psychometric data reported in the French technical manual of the WISC-IV. Afterward, Grégoire (2009) has proposed the French GAI tables on the basis of the French standardization data.

While the FSIQ and the GAI are highly correlated ($r = .91$ for the French WISC-IV), it is important to remember that the GAI is not a substitute for the FSIQ. As mentioned before, the GAI was proposed because some learning disabled children exhibit deficits in working memory and/or in processing speed. In the WISC-IV, because the FSIQ relies too heavily on working memory and processing speed, the FSIQ might underestimate the level of cognitive functioning. This is why Sattler and Ryan (2009, p. 135) stated that "you compute GAI when you want a measure of cognitive ability that is less sensitive to the working memory and processing speed components of the FSIQ". In other words, the GAI would be a better estimate of general cognitive ability when the WMI and the PSI are lower than the VCI and the PRI. Similarly, Newman, Sparrow, and Pfeiffer (2008, p. 225) argued that it is very important to consider the GAI with gifted children, because this single score "may often be more advisable to use than the FSIQ in identifying children who are gifted". Overall, it has been suggested that the GAI would be useful for clinical situations with specific learning disabilities, attention-deficit/hyperactivity disorder (ADHD), language disorders, and autism spectrum disorder. However, because working memory and processing speed are critical components of overall intellectual ability, they might not be discarded. Indeed, many studies have shown that high working memory capacity and proficient processing speed facilitate learning and the resolution of complex cognitive tasks (Ackerman, Beier, & Boyle, 2005; de Ribaupierre, Fagot, & Lecerf, 2011; de Ribaupierre & Lecerf, 2006; Gignac, 2014; Salthouse, 1992). To be more explicit, reporting the GAI instead of the FSIQ because the child scored low on working memory and/or on processing speed subtests is not recommended. Anyway, the GAI must be reported jointly with the Cognitive Proficiency Index (CPI).

The CPI summarizes performance on working memory and processing speed subtests into a single composite score, and is the counterpart of the GAI. These subtests are used to assess the proficiency at which an individual process cognitive information (Saklofske, Zhu, Coalson, Raiford, & Weiss, 2010; Saklofske et al., 2012). Remember that several studies have shown that these basic abilities are central to the fluid reasoning process, to the visual process, etc. (Gignac, 2014; Salthouse, 1991). As far as we know, the idea to combine WMI and PSI into a single score was first suggested by Dumont and Willis (2001) who called this composite score DWI-II (i.e., Dumont-Willis Index-2). By excluding the VCI and the PRI, the CPI provides additional views into individual's cognitive abilities. According to Sattler and Ryan (2009, p. 136), we can calculate the CPI when we need a "measure of cognitive ability that is less sensitive to the verbal comprehension and perceptual reasoning components of the FSIQ". That's why it has been suggested to complement the GAI with the CPI to determine strengths and weaknesses. Thus, in some situations, the CPI and the GAI can provide different views into a child's cognitive abilities. In addition, it has been recommended to compare systematically

[1] While the U.S. WISC-V is already published, this is not the case for the French version.

[2] However, Lecerf, Rossier, Favez, Reverte, and Coleaux (2010) have shown that the French WISC-IV was more adequately described with 6 factors.