Intelligence 42 (2014) 5–21

Contents lists available at ScienceDirect

Intelligence

The development and validation of the Self-Report Measure of Cognitive Abilities: A multitrait–multimethod study

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ARTICLE INFO

Article history:
Received 23 February 2012
Received in revised form 10 September 2013
Accepted 17 September 2013
Available online xxxx

Keywords:
Cattell-Horn-Carroll
Self-report
Scale development

ABSTRACT

The expansion in our understanding of the structure of differential cognitive abilities afforded by the Cattell–Horn–Carroll (CHC) model has brought with it the need to provide practitioners with efficient and effective methods for screening which abilities most critically require assessment. A Self-Report Measure of Cognitive Abilities could assist practitioners with this process. This article outlines the development and initial validation of the Self-Report Measure of Cognitive Abilities (SRMCA), a multi-item measure designed to indicate cognitive functioning in the CHC ability areas of Fluid reasoning (Gf), Comprehension-knowledge (Gc), and Visual processing (Gv). Validity was initially investigated and supported using exploratory factor analysis, and then cross-validated on a second sample using structural equation modelling (SEM). Subsequently, SEM based multitrait–multimethod analysis of the second sample confirmed convergent validity for the Gc and Gv subscales, but not the Gf subscale. The extent of method variance influence on the SRMCA was found to be non-existent, a markedly different result to that found for the single-item self-estimates of cognitive abilities. Results thus indicate that the use of multiple and specific items allows for self-ratings of distinct cognitive ability areas to be independent of one another. Suggestions for future research aimed at extending the current study are provided.

1. Introduction

The Cattell–Horn–Carroll (CHC) theory of cognitive abilities has profoundly impacted the field of intellectual theory and assessment by greatly expanding our understanding of the full range of differential cognitive abilities. However, as Carroll (1997) explains, this expansion in knowledge brings with it practical and economic implications:

> The theory has major implications for practical assessment of individuals in clinical, educational, or industrial settings. It appears to prescribe that individuals should be assessed with regard to the *total range* of abilities the theory specifies. Any such prescription would of course create enormous problems; generally there would not be sufficient time to conduct assessments…of all the abilities that exist…Research is needed to spell out how the assessor can select what abilities need to be tested in particular cases (p. 129, emphasis in original).

There is thus a significant need for an effective and efficient method for screening ability areas to determine which ones critically require assessment. This could potentially be achieved via reliable and valid self-report measures; with results informing the selection of appropriate subtests from conventional intelligence tests using cross-battery assessment principles (refer to Flanagan, Ortiz, & Alfonso, 2013). While abbreviated versions of longer cognitive ability tests exist which can be used for screening purposes (e.g., K-BIT; Kaufman & Kaufman, 2004; WASI-II; Wechsler, 2011; see also Meyers, Zellinger, Kockler, Wagner, & Miller, 2013), the inherent danger with such instruments is that these testlets are used in lieu of longer, more valid and reliable measures. Arguably such a risk would be non-existent were self-reports used for screening. Additionally abbreviated testlets are largely

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http://dx.doi.org/10.1016/j.intell.2013.09.004

sufficient only for providing a measure of general ability (Kaufman & Kaufman, 2001), whereas increasingly research and practice is moving away from the notion of general intelligence due to questions over its clinical utility (Kamphaus, Winsor, Rowe, & Kim, 2012; McGrew, Flanagan, Keith, & Vanderwood, 1997). In addition to informing the creation of hypothesis driven assessments, self-reports of cognitive abilities, when compared with parallel performance measures, can provide insights into why some individual's over- and or under-achieve (Jacobs et al., 2012, Soh and Jacobs, 2013). However this area of research has been limited by the use of questionable measures (detailed further below) and would therefore also greatly benefit from the development of a psychometrically robust Self-Report Measure of Cognitive Abilities. The purpose of this research was therefore to devise and assess the validity of an initial self-report measure of three key CHC abilities.

1.1. CHC theory and its impact on intelligence testing

CHC theory is viewed as the most influential and psychometrically validated theory of cognitive abilities currently available (Alfonso, Flanagan, & Radwin, 2005; Keith & Reynolds, 2010; McGrew, 2005, 2009). By merging Cattell and Horn's (Cattell, 1971; Horn, 1985, 1988) G*f*–G*c* theory with Carroll's (1993) Three-Stratum theory, CHC is essentially an amalgamation of over 100 years of psychometric research. The CHC model, which is supported by developmental, neurocognitive, and heritability evidence (Flanagan, Ortiz, & Alfonso, 2007; Horn & Blankson, 2005), delineates 16 broad cognitive abilities (e.g., Fluid reasoning, Comprehension-knowledge) which subsume more than 70 narrow abilities (Schneider & McGrew, 2012). Refer to McGrew (2009) for detailed descriptions of broad and narrow abilities. In the late 1990s, subtests from all of the major intelligence test batteries were classified in terms of the CHC model which highlighted the insufficient comprehensiveness of virtually all (Flanagan et al., 2007). For example, the Wechsler Intelligence Scale for Children—Third edition (WISC-III; Wechsler, 1991) adequately measured only three of the seven CHC abilities identified as important for academic achievement, while the Stanford–Binet—Fourth edition (SB-IV; Thorndike, Hagen, & Sattler, 1986) measured only four. These tests were subsequently revised to provide a measure of more CHC abilities meaning that now "…nearly all intelligence batteries that are used with some regularity subscribe either explicitly or implicitly to CHC theory" (Alfonso et al., 2005, p. 193).

1.2. The validity of self-reports of cognitive abilities

Self-report measures are used in the assessment of a wide variety of psychological constructs, such as personality. Advantages include low cost and easy administration, the capacity to assess large numbers of individuals simultaneously, and a less anxiety inducing assessment format (Furnham, 2001; Paulhus, Lysy, & Yik, 1998; Simms, 2008). Compared to performance measures of assessment however, self-report measures are essentially subjective opinion polls susceptible to the influence of an array of confounding variables, such as response and self-presentational biases (Hofstee, 1994).

Research investigating the validity of self-reports of cognitive abilities suggests that individuals have only limited insight as correlations between self-report and performance measures rarely exceed .3 (Chamorro-Premuzic & Furnham, 2005; Freund & Kasten, 2012; Furnham, 2001; Paulhus et al., 1998). However, limitations of the extant research could potentially be suppressing the validity coefficients obtained. This includes (a) the use of intelligence theories that lack validity evidence, such as Gardner's theory of Multiple Intelligences (Waterhouse, 2006); (b) the predominant use of single- as opposed to multi-item measures, with the former containing greater error variance and likely lower content validity than the latter (Epstein, 1983; Hoyt, Warbasse, & Chu, 2006); and (c) the use of criterion measures that do not appropriately match the specificity of the self-report obtained (e.g., correlating a self-report of a specific broad ability area, such as Comprehension-knowledge, with a performance measure of general intelligence). When self-reports of specific cognitive ability areas have been correlated with performance measures that match the specificity of the self-report, correlations between the two often exceed .3 (e.g., Chamorro-Premuzic, Furnham, & Moutafi, 2004; Fingerman & Perlmutter, 1994; Furnham & Dissou, 2007; Miller & Davis, 1992; Proyer & Ruch, 2009; Quaiser-Pohl & Lehmann, 2002; Visser, Ashton, & Vernon, 2008). Furthermore, self-reports of specific cognitive ability areas are generally found to correlate higher with parallel than with non-parallel performance measures (e.g., Ackerman & Wolman, 2007; Furnham, Kidwai, & Thomas, 2001; Rammstedt & Rammsayer, 2002; Steinmayr & Spinath, 2009) indicating that individuals are capable of differentiating between distinct cognitive abilities when providing self-ratings.

Only one study was located that reported the development and validation of a multi-item report measure designed to provide an indication of level of cognitive functioning in distinct CHC ability areas. Waschbusch, Daleiden, and Drabman (2000) investigated the ability of parents to discriminate their child's cognitive strengths and weaknesses by devising a multi-item parent-report measure of CHC broad abilities. Convergent validity was assessed by comparing parent's reports with the child's test scores. Out of the 20 parallel correlations reported, 65% of them were greater than .30, going as high as .54. However, the measure failed to display adequate discriminant validity as nearly all of the parent report subscales correlated higher with non-parallel than parallel performance measures. The failure to factor analyze the measure (potentially due to limited sample size) precluded a determination of whether the lack of discriminant validity was the result of cross-loading items going undetected, or due to parent reports being based on one overall general ability factor rather than distinct broad ability factors as was hypothesised. This study highlights the importance of investigating the factorial validity of newly developed measures, even when the measure has been based on a well-validated theory.

In addition to factorial validity, evidence in support of the convergent and discriminant validity of a psychological measure is required (Messick, 1995). The multitrait–multimethod (MTMM) matrix (Campbell & Fiske, 1959), which is now commonly analyzed within a structural equation modelling (SEM) framework, is a popular method for assessing external validity. However, this method appears to have not yet