



Are intelligence tests measurement invariant over time? Investigating the nature of the Flynn effect

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Received 11 June 2003; received in revised form 7 July 2004; accepted 8 July 2004

Abstract

The gains of scores on standardized intelligence tests (i.e., Flynn effect) have been the subject of extensive debate concerning their nature, causes, and implications. The aim of the present study is to investigate whether five intelligence tests are measurement invariant with respect to cohort. Measurement invariance implies that gains over the years can be attributed to increases in the latent variables that the tests purport to measure. The studies reported contain original data of Dutch Wechsler Adult Intelligence Scale (WAIS) gains from 1967 to 1999, Dutch Differential Aptitude Test (DAT) gains from 1984 to 1995, gains on a Dutch children intelligence test (RAKIT) from 1982 to 1993, and reanalyses of results from Must, Must, and Raudik [*Intelligence 167* (2003) 1–11] and Teasdale and Owen [*Intelligence 28* (2000) 115–120]. The results of multigroup confirmatory factor analyses clearly indicate that measurement invariance with respect to cohorts is untenable. Uniform measurement bias is observed in some, but not all subtests. The implications of these findings are discussed.

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Keywords: Intelligence tests; Factorial invariance; Flynn effect

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1. Introduction

Ever since Flynn (1984, 1987) documented worldwide increases in scores on standardized intelligence tests, there has been extensive debate about the nature, causes, and implications of these increases (e.g., Neisser, 1998). There are several unresolved issues concerning the nature of these increases, now commonly denoted “the Flynn effect.” One issue concerns the exact cognitive abilities that have increased over the years. The rise of scores is usually found to be greater on tests of fluid intelligence (e.g., Raven Progressive Matrices) than on tests of crystallized intelligence, especially on verbal IQ tests (Colom, Andres-Pueyo, & Juan-Espinosa, 1998; Emanuelsson, Reuterberg, & Svensson, 1993; Emanuelsson & Svensson, 1990; Flynn, 1987, 1998b; Lynn & Hampson, 1986, 1989; Teasdale & Owen, 2000). Differential increases have raised the question whether the gains can be related to an increase in general intelligence, or *g* (Colom & García-López, 2003; Colom, Juan Espinosa, & Garcia, 2001; Flynn, 1999a, 1999b, 2000a; Jensen, 1998; Must, Must, & Raudik, 2003; Rushton, 1999, 2000).

A second, more fundamental, issue is whether the increases are genuine increases in cognitive ability, or that they merely reflect measurement artifacts, such as heightened test sophistication or altered test-taking strategies (Brand, 1987; 1990; Brand, Freshwater, & Dockrell, 1989; Flynn, 1990; Jensen, 1996; Rodgers, 1998). The proponents of the view that the intelligence gains are genuine have searched for real-world signs of the increase (e.g., Howard, 1999, 2001). They have offered several explanations, including improved nutrition (Lynn, 1989, 1990; Martorell, 1998), a trend towards smaller families (Zajonc & Mullally, 1997), better education (Husén & Tuijnman, 1991; Teasdale & Owen, 1989; Tuddenham, 1948), greater environmental complexity (Schooler, 1998), and heterosis (Mingroni, 2004).

If, on the other hand, the increases are due to a measurement artifact, this obviously complicates the comparison of cohorts with respect to intelligence test scores. In addition, this may possibly have implications for the comparisons of other groups (e.g., Blacks and Whites in the United States). Based on his results, Flynn (1987, p. 189) questioned the validity of IQ tests and suggested that other between-group differences on IQ tests may not reflect true intelligence differences. Furthermore, Flynn (1998a, p. 40) states that “massive IQ gains add viability to an environmental hypothesis about the IQ gap between Black and White Americans.” High heritability estimates of IQ are supposedly incompatible with the hypothesized environmental causes of the secular increases (but see Mingroni, 2004). Dickens and Flynn (2001) have recently proposed a formal model that can account for this paradox. This extensive model offers an explanation of the Flynn effect in the presence of high heritability. However, the model does not address the issue of the nature of the score gain because it is primarily concerned with measured intelligence or IQ.

The purpose of the present paper is to consider the nature of the Flynn effect. Our specific aim is to investigate whether secular gains found on five different multivariate intelligence tests reflect gains in the common factors, or hypothetical constructs, that these tests are supposed to measure. These common factors are typically identified by means of factor analyses of test scores obtained within a group (cohort). To this end, we investigate whether these tests are factorially invariant with respect to cohort. Factorial invariance implies that the same constructs are measured in different cohorts and that the observed gains in scores can be accounted for by gains on these latent constructs (Lubke, Dolan, Kelderman, & Mellenbergh, 2003; Meredith, 1993). In addition, factorial invariance implies measurement invariance with respect to cohort (Meredith, 1993), which, in turn, means that the

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