



Role of mental abilities and mental tests in explaining high-school grades[☆]



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ABSTRACT

It is well-known that some students earn higher grades than others; however, published research on the mental abilities that are correlated with high school grades is sparse. Two studies examined the relationship between different mental abilities and high school grades. Study 1 showed that the personality trait conscientiousness predicted high school grades ($r = .32$) almost as well as g ($r = .37$ to $.40$). In Study 2, the relationship between general mental ability (g) and high school grades was linear and fairness analyses indicated slight overprediction for Hispanics and Blacks and underprediction for females. Validity was lowered slightly by group preferences. With the exception of mathematical knowledge, the correlation between mental abilities and high school grades in both studies was largely attributable to g rather than specific abilities (s) measured by each test. Additional analyses showed that grade point averages are reliable and conscientiousness and g do not interact when predicting high school grades.

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1. Introduction

Research on predictors of job and training performance paints a clear picture: general mental ability (g) is primarily responsible for the predictive power of standardized tests of mental abilities, with specific mental abilities (s) adding little or nothing to the prediction of *job* and *training* performance (Brown, Le, & Schmidt, 2006; Gottfredson, 2002; Hunter, 1983a, 1983b, 1984, 1985, 1986; Jensen, 1986; Olea & Ree, 1994; Ree & Earles, 1991; Ree, Earles, & Teachout, 1994; Sackett & Wilk, 1994; Schmidt, 1988, 2011; Schmidt & Hunter, 1996 [see Scenario 6], Schmidt & Hunter, 2004; Schmidt, Hunter, & Caplan, 1981; Schmidt, Ones, & Hunter, 1992; Thorndike, 1985, 1986). However, there is a lack of research on the role of specific mental abilities in the relationship between standardized tests and *academic* performance using large samples. Instead, much of the large sample research focuses on the validity of specific operational tests (e.g., the SAT, the ACT), which only include a small number of subtests. The studies that have been conducted on the role of s have used small sample sizes. Conry and Plant (1965) and Anderson (1971) examined the criterion-related validity of scores from test batteries measuring multiple abilities for high school (HS) performance, but only used 98 and 127 students, respectively. Jensen (1998) noted the

lack of research, stating “Surprisingly little of this applied literature on test validity, however, examines the degree to which g itself, as compared to other factors and specificity, contributes to tests’ validity. Fortunately, the few studies that focus specifically on this question have been conducted by the armed forces and by the U.S. Employment Service of the Department of Labor [i.e., Hunter & Schmidt]. These studies, based on huge samples, are technically excellent” (p. 271).

There has been research in the mental abilities’ literature which suggests that specific abilities might be related to academic performance (above and beyond g). Reeve (2004) has shown that narrow latent abilities can add incremental validity over g when predicting scores on achievement tests. Additionally, there is some evidence that perceptual speed adds incremental validity for predicting clerical job performance and that spatial ability adds incremental validity for predicting job performance for certain technical jobs (Gottfredson, 2002; Jensen, 1998; Johnson & Bouchard, 2005; Schmidt, 1988). Past research also has demonstrated the importance of spatial ability for scientific, technical, engineering, and math (STEM) jobs (Kell, Lubinski, Benbow, & Steiger, 2013; Lubinski, 2010; Wai, Lubinski, & Benbow, 2009; Webb, Lubinski, & Benbow, 2007). Additionally, Carroll’s (1993) meaningful memory factor has emerged as a unique predictor of training performance (Cucina, Su, Busciglio, & Thompson Peyton, 2015) and Coyle and Pillow (2008) have shown that the non- g residuals of the SAT and ACT predict undergraduate academic performance.

Furthermore, most criterion-related validation work in academic settings has focused on college (Hezlett et al., 2001) and graduate-level performance (e.g., Kuncel & Hezlett, 2007; Kuncel, Hezlett, & Ones, 2001, 2004); few studies exist on HS performance. Grigorenko et al. (2009) stated that “In contrast to [the] rich literature on college-

[☆] The views expressed in this paper are those of the authors and do not necessarily reflect the views of U.S. Customs and Border Protection or the U.S. Federal Government. Portions of this research have been presented at the annual meetings of the Society for Industrial and Organizational Psychology (Division 14 of the American Psychological Association) in 2014 and will be presented at the American Educational Research Association in 2016.

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level tests, there is a much smaller body of literature on the predictive validity of secondary-level standardized tests" (p. 964). This is somewhat surprising given that admissions-testing programs do exist for high schools. For example, the *New York City (2010)* school system uses the Specialized High Schools Admissions Test (SHSAT), which consists of verbal and mathematical tests, and many private schools use the Secondary School Admission Test (SSAT; SSAT Board, 2012), which consists of reading comprehension, quantitative, verbal, and essay tests. According to a critique by *Feinman (2008)*, no criterion-related validation studies have been conducted on the SHSAT; however, *Grigorenko et al. (2009)* noted that there is some research on the validity of the SSAT (they reported a validity of .377 in their largest sample). Some studies have shown that HS grades are related to college entrance examination scores (e.g., *Mattern & Patterson, 2013*) and a study by *Chamorro-Premuzic, Quiroga, and Colom (2009)* reported that HS grades were related to college entrance examination scores but not to measures of fluid, crystallized, and visual intelligence. Although there are some studies examining the relationship between mental abilities and achievement tests (e.g., *Furnham & Mosen, 2009; Furnham, Rinaldelli-Tabaton, & Chamorro-Premuzic, 2011; Reeve, 2004*) and teacher ratings (*Chamorro-Premuzic, Harlaar, Greven, & Plomin, 2010*) for high school students, these studies did not use overall course grades (e.g., grade point average) as a criterion.

1.1. Conscientiousness and HS grades

In contrast to the mental abilities' literature, there is more extensive research on the factors of personality that predict academic performance. Factor analytic work indicates that five large factors underlie personality variables (*Digman, 1990; Digman & Takemoto-Chock, 1981; Norman, 1963; Tupes & Christal, 1961, 1992*). These factors include Neuroticism (i.e., negative emotionality), Extraversion (i.e., sociability and energy level), Openness to Experience (i.e., imagination, intellect and culture), Agreeableness (i.e., cooperation, friendliness and consideration), and Conscientiousness (i.e., dutifulness and achievement-striving). The latter factor has been given prominence for predicting academic performance in a review by *de Raad & Schouwenburg (1996)*; similar conclusions were drawn from the results of a meta-analysis by *McAbee and Oswald (2013)*. This factor also predicts job and training performance (*Barrick & Mount, 1991*). Conscientiousness taps aspects of personality such as dutifulness and achievement-striving. *Digman and Takemoto-Chock (1981)* interpreted this dimension as a person's will to achieve, whereas *Cattell (1957, 1973)* interpreted it as the strength of the superego. This dimension is quite similar to *Webb's (1915)* factor of volition or will. Individuals who are high in Conscientiousness are persevering, responsible, dependable, ambitious and scrupulous. Whereas individuals low in Conscientiousness can be described as fickle, likely to quit, unambitious, undependable, careless, impulsive, lazy, and lacking in self-control.

1.2. The importance of studying HS grades

Studying HS grades as a criterion is important for several reasons. First, the use of standardized testing for college admissions remains controversial, with many critics arguing that more weight be given to HS grades or that HS grades be used in lieu of standardized test scores. Even proponents of the SAT and ACT (e.g., *Kobrin, Sinharay, Haberman, & Chajewski, 2011*) suggest that test scores and HS grade point average (GPA) should be used in combination (e.g., using a regression equation). However, there is relatively little research on what psychological constructs HS grades measure. Since both HS grades and training performance are learning activities, we hypothesize that HS grades will be predicted by *g* and conscientiousness, just as training performance is (*Schmidt & Hunter, 1998*). Second, recent reforms in the education system (e.g., No Child Left Behind) have given rise to alternative approaches to developing curricula for public schools. For example, several schools (see *Seider & Geiger, 2009*) have adopted *Gardner's (1983)*

multiple intelligences framework into their curricula, customizing instruction in different modes to match students' strengths and weaknesses on different specific abilities (*Armstrong, 1994; Blythe & Gardner, 1990; Dastgoshadeh & Jalilzadeh, 2011; Gardner & Hatch, 1989; Howard Gardner Multiple Intelligence School, 2010; Su, 2012*). This approach is partially predicated on the assumption that different abilities contribute to academic success. Third, some specialized public high schools, and many private high schools, use standardized tests as part of their admissions process (see the discussion above); however, the criterion-related validity of mental-abilities tests in this setting remains largely unexamined. Fourth, the College Board announced plans to revamp the SAT (*Strauss, 2013*); however, there is relatively little large-scale research on the correlates of academic performance above and beyond the SAT and ACT. Fifth, there is very little published research on the reliability of HSGPA. *Camara and Michaelides (2005, p. 2)* suggested that HSGPA might be "unreliable" (p. 2) and *Gesier and Santelices (2007)* indicated that HSGPA has a "reputation for 'unreliability'" (p. 27); however, neither examined data to estimate the reliability of HSGPA. There is evidence that similar criteria have reasonably adequate reliability coefficients in the .80s—*Ramist, Lewis, and McCamley (1990)* conducted a multi-sample study (with 40,622 students in 38 colleges) which estimated the reliability of Freshman undergraduate GPA to be .82.

In this paper, we present two empirical studies examining the relationship between mental abilities and academic performance. Study 1 also examined the relationship between the conscientiousness personality factor and academic performance (including the possibility of an interaction between *g* and conscientiousness). Study 2 added analyses examining the reliability of HSGPA, the presence of predictive bias, and the impact of minority preferences on the criterion-related validity of mental ability test scores.

2. Study 1

The first study examined the criterion-related validity of a large battery of mental abilities tests and a measure of conscientiousness in the prediction of HS grades. Past research suggests that *g*, not *s*, predicts job/training performance, thus we predict the same finding for our

Table 1
Demographic Statistics.

Variable	Frequency	Percent
Gender		
Male	155,109	48.2
Female	166,479	51.8
Missing	1	<.1
Race/ethnicity ^a		
White (non-Hispanic)	132,822	41.3
Black (non-Hispanic)	4612	1.4
Hispanic (non-Black) ^b	301	0.1
Native American ^c	209	0.1
Asian	935	0.3
Missing/other	182,710	56.8
Grade		
Ninth	84,526	26.3
Tenth	84,457	26.3
Eleventh	80,848	25.1
Twelfth	71,757	22.3
Missing	1	<.1
	Mean	SD
Age ^d	15.79	1.26
Missing	7183	2.2%
Total	321,589	

^a We use modern terminology to describe the races/ethnicities. When Project TALENT was begun (in the 1960s) other terms were used for these groups.

^b Includes cases labeled as "Mexican American," "Puerto Rican American," and "Cuban".

^c Includes cases labeled as "American Indian" and "Eskimo".

^d Age was missing for 7183 cases (2.2% of the sample).

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