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Using personality and cognitive ability to predict academic achievement in a young adult sample

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ABSTRACT

This study examined the relationship between cognitive ability, personality, and academic achievement in post-secondary students, using latent variable models. Testing both simple and complex relationships, we found that cognitive ability and personality predicted reading achievement independently, but that they interact when predicting math achievement – at least in the Conscientiousness and Openness to Experience domains.

1. Introduction

Academic success plays a vital role in predicting students' future opportunities and aspirations. While there is a robust literature showing that cognitive ability and educational achievement are strongly related (Jensen, 1998), more recently, scholars have been investigating the role of other individual differences, such as motivation and learning styles (Cheng & Ickes, 2009), with one of the more promising avenues exploring how personality relates to academic achievement.

1.1. Academic achievement and the personality

Researchers examining the relationship between personality traits and academic achievement often utilize the framework provided by the Five-Factor Model (FFM; O'Connor & Paunonen, 2007), as is one of the most widely recognized and accepted conceptualizations (Hong, Paunonen, & Slade, 2008; John & Srivastava, 1999), although there are alternative conceptualizations (e.g., Eysenck, 1994; Zuckerman, 1994). According to the FFM, the five basic personality traits include: Agreeableness (A), Conscientiousness (C), Extraversion (E), Neuroticism (N), and Openness to Experience (O). These five factors have demonstrated a relationship to many life outcomes, such as vocational success, establishing friendships/relationships, and health (Deary, 2010; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007). Moreover, individual differences in these five factors begin to exert their influence as early as adolescence, making them important variables to consider when investigating psychological processes in adolescents and emerging adults (Caspi, Roberts, & Shiner, 2005; Robins, Fraley, Roberts, & Trzesniewski, 2001).

The empirical evidence surrounding the role that personality traits play in academic achievement is mixed for all the FFM factors except C, which is almost universally positively associated with academic achievement (Poropat, 2009). For example, some studies find O to have a positive relationship with academic achievement (e.g., de Fruyt & Mervielde, 1996; Farsides & Woodfield, 2003; Laidra, Pullmann, & Allik, 2007), while other studies show no such relationship (Busato, Prins, Elshout, & Hamaker, 2000; Chamorro-Premuzic & Furnham, 2003b; Duff, Boyle, Dunleavy, & Ferguson, 2004). The same can be said about A, E and N, as some studies find a negative relationship between them and academic achievement exists (Chamorro-Premuzic, Furnham, & Moutafi, 2004; Furnham, Chamorro-Premuzic, & McDougall, 2003; Paunonen, 1998; Rothstein, Paunonen, Rush, & King, 1994), while others suggest the relationship is positive (De Raad & Schouwenburg, 1996; Rothstein et al., 1994; Sánchez, Rejano, & Rodríguez, 2001), or does not exist (Busato et al., 2000; Duff et al., 2004; O'Connor & Paunonen, 2007).

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One possible reason for the mixed evidence is the age of respondents (Poropat, 2009). For example, E tends to have a positive relationship with academic achievement in primary students (Furnham et al., 2003), but a negative one with secondary and post-secondary students (Eysenck, 1996). Likewise, N tends to be positively related to academic achievement in middle school, but negatively related amongst post-secondary students (Eysenck, 1996).

Some investigators have controlled for the possible age confound by examining samples homogenous in age, such as students in post-secondary education (Busato et al., 2000; Chamorro-Premuzic & Furnham, 2003a, 2003b; de Fruyt & Mervielde, 1996; Duff et al., 2004; Farsides & Woodfield, 2003; Furnham et al., 2003; Paunonen & Ashton, 2001; Sánchez et al., 2001; Wolfe & Johnson, 1995). The results from such studies indicate that C tends to have a positive relationship with academic achievement, N likely has a negative relationship, and A likely has a negligible relationship. O and E, however, have more mixed results, showing both positive and negative relationships.

Even though studies conducted at post-secondary levels show some similarities in their results, they also show consistent problems. One of the most salient problems is measurement (Poropat, 2009; Trapmann, Hell, Hirn, & Schuler, 2007), especially concerning academic achievement. Most studies use exam or final course grades (e.g., Chamorro-Premuzic & Furnham, 2003a, 2003b; Farsides & Woodfield, 2003; Furnham et al., 2003; Paunonen & Ashton, 2001), or some form of GPA (e.g., Duff et al., 2004; Laidra et al., 2007), which can have numerous problems, especially when comparing scores across majors (Berry & Sackett, 2009). Another consistent problem is the lack of probing for more complex ways in which personality might relate to academic achievement, such as a multidimensional relationship with cognitive ability. While many studies have investigated how cognitive ability and personality relate to academic achievement singly, there is a growing consensus that the two might work together, with some going so far as to posit that cognitive ability is just a dimension of personality (Brand, 1994). To this end, some have suggested that personality and cognitive ability are independent predictors of achievement (e.g., Poropat, 2009), while others have suggested that personality and cognitive ability work through each other (i.e., mediation; Noftle & Robins, 2007) or interact with each other (i.e., moderation; O'Connor & Paunonen, 2007).

1.2. Current study

In the present study, we examine how cognitive ability and personality relate to academic achievement in post-secondary students. We attempt to address some problems of other studies by using latent variable models of academic achievement, and by testing both simple and more complex relationships for how cognitive ability and personality relate to each other and academic achievement. Specifically, we seek to answer the following questions: (a) what is the relationship between the FFM personality factors and academic achievement, when academic achievement is measured as a latent variable? (b) Do personality and cognitive ability work independently, through each other, or do they interact when predicting academic achievement?

2. Method

2.1. Sample

Participants in this study were 197 students from a Midwestern university in the United States of America, all of which came from a class in the general education curriculum. The mean age was 19.15 years (SD: 1.19, range: 18–25), 60% were female, 84% were underclassman, and a majority of the respondents (98%) were Caucasian. All participants were given a battery of tests that included measures of cognitive ability, personality, and academic achievement.

2.2. Instruments

2.2.1. Cognitive ability

The study used six measures of cognitive ability to create a general intelligence (*g*) variable: (a) the Analogical Reasoning, Categorical Classification, and Sequential Reasoning index scores from Comprehensive Test of Nonverbal Intelligence-Second Edition (CTONI-2; Hammill, Pearson, & Wiederholt, 2009); (b) the Verbal index from the Reynolds Intellectual Assessment Scales (RIAS; Reynolds & Kamphaus, 2003)[1]; and (c) the Shipley Institute of Living Scale-Second Edition (Shipley-2; Shipley, Gruber, Martin, & Klein, 2010).

The Shipley-2 (Shipley et al., 2010) is comprised of three subtests. Like its precursor (Shipley, 1940), it contains *Vocabulary* and *Abstraction* subtests. The new edition added the *Block Patterns* subtest, a paper-and-pencil version of Kohs (1923) block designs. The present study used the amalgamated score from the Vocabulary and Abstraction tasks, as well as Block Patterns' standardized score.

2.2.2. Personality

We measured personality using the International Personality Item Pool (IPIP; Goldberg et al., 2006) version of the NEO Personality Inventory-Revised (NEO-PI-R; Costa & McCrae, 1992).

2.2.3. Academic achievement

We gathered multiple measures of mathematics and reading: (a) the mathematics and verbal sections of the ACT and SAT; (b) the Math Computation/Reasoning and Reading subtests of the Wide Range Achievement Test-Third Edition (WRAT-3; Wilkinson, 1993); and (c) the Quick Picture Reading Test (Klein & Herzberg, 2010), a brief norm-referenced measure of reading ability/vocabulary.

2.3. Assessing model fit

We used multiple fit indexes in order to assess model fit: (a) Root Mean Square Error of Approximation (RMSEA), (b) Comparative Fit Index (CFI), and (c) the Standardized Root Mean Square Residual (SRMR). These indexes were chosen since they represent both absolute and relative fit indices, and they tend to perform well in evaluating different models (Marsh, Hau, & Grayson, 2005). In addition, we also inspected each model's χ^2 value and its associated *p*-value (Barrett, 2007).

For the present study's model-fit criteria, we used the following: (a) χ^2 *p*-values greater than 0.05; (b) RMSEA values less than 0.075, (halfway between 0.050 and 0.100; Chen, Curran, Bollen, Kirby, & Paxton, 2008); (c) CFI values greater than 0.960 (Yu, 2002); and (d) SRMR values less than 0.080, (Sivo, Xitao, Witta, & Willse, 2006).

3. Results

3.1. Data inspection

We investigated the data for univariate and multivariate normality (DeCarlo, 1997). Descriptive statistics are given in Table 1.

[1] We did not use the RIAS' fluid abilities subtests as there is evidence that these scores might not be apt measures of their intended constructs (Beaujean, Firmin, Michonski, Berry, & Johnson, 2010).