Personality and Individual Differences 61–62 (2014) 63–68

Contents lists available at ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com/locate/paid

Impulsivity, intelligence, and academic performance: Testing the interaction hypothesis

J.H. Lozano *, F. Gordillo, M.A. Pérez

Camilo José Cela University, Faculty of Health Sciences (Department of Psychology), Castillo de Alarcón, 49, Villafranca del Castillo, 28692 Madrid, Spain

ARTICLE INFO

Article history:
Received 23 September 2013
Received in revised form 23 December 2013
Accepted 3 January 2014
Available online 4 February 2014

Keywords:
Impulsivity
Intelligence
Academic performance
Interaction
Latent variables

ABSTRACT

Previous research suggests a moderator effect of intelligence on the relationship between impulsivity and academic achievement. However, the interaction hypothesis has not been adequately tested so far. The present study was aimed to analyze the interrelations between impulsivity, intelligence, and academic performance, with special interest in testing the interaction effect between impulsivity and intelligence in the prediction of performance. To that end, 174 university students, aged from 18 to 37 years, were tested. Analyses were carried out at the latent level in order to minimize measurement error and to increase statistical power. The main findings of the study show that: (a) impulsivity was negatively related to both academic performance and intelligence; (b) intelligence was positively related to academic performance; (c) impulsivity and intelligence contributed significantly and independently to predict and explain academic performance; and (d) there was a significant interaction effect between impulsivity and intelligence in predicting academic performance, such that impulsivity was more strongly associated with performance among the more intelligent students than among the less intelligent ones.

1. Introduction

The prediction of academic achievement constitutes one of the most important research topics in Psychology. Among all the candidates to predict academic performance, intelligence has revealed as the most effective single predictor (Kuncel, Hezlett, & Ones, 2004). However, recent research suggest that personality measures may be equally effective (Chamorro-Premuzic & Furnham, 2003; Colom, Escorial, Shih, & Privado, 2007; Duckworth & Seligman, 2005; Laidra, Pullmann, & Allik, 2007). Within this framework, one personality measure that is increasingly receiving more attention is impulsivity (Frick et al., 1991; Spinella & Milley, 2003; Vigil-Colet & Morales-Vives, 2005).

1.1. Impulsivity, intelligence, and academic performance

There are several studies in which impulsivity has been found to be related to low academic achievement (Frick et al., 1991; Spinella & Milley, 2003; Vigil-Colet & Morales-Vives, 2005). Additionally, impulsivity seems to be moderately and negatively related to reasoning (Schweizer, 2002) and intelligence (Corr & Kumari, 1998; De Wit, Flory, Acheson, McCloskey, & Manuck, 2007; Harmon-Jones, Barratt, & Wigg, 1997; Kuntsi et al., 2004; Lynam, Moffitt, & Stouthamer-Loeber, 1993; Russo, De Pascalis, Varriale, & Barratt, 2008; Vigil-Colet & Morales-Vives, 2005).

Although the correlational methodology employed in the above mentioned studies does not allow for any causal interpretation, one possible explanation for the bivariate interrelations among impulsivity, intelligence, and academic achievement may reside in the individual differences in the tendency to discount delayed rewards. Impulsivity entails a tendency to discount rewards that are delayed in time in favor of immediate gratification (Ostaszewski, 1996; Richards, Zhang, Mitchell, & de Witt, 1999). In addition, intelligence is negatively associated to such tendency (Shamosh & Gray, 2008; Shamosh et al., 2008); that is, the more intelligent person tends to seek further into consequences of his or her behavior. The educational process, in this regard, may be viewed as a long-term goal-oriented undertaking, which may be undermined by the tendency to act on immediate demands characteristic of impulsive and less intelligent individuals (Spinella & Milley, 2003). Nevertheless, other alternative or complementary explanations are also possible. As Zeidner posited (1995), it also may be argued that a student of low intelligence may experience more frustration in the educational process, developing an aggressive and impulsive attitude. Moreover, children with low intelligence likely have parents with low intelligence, who may provide poorer conditions and less discipline.

At the biological level, the link between impulsivity, intelligence, and academic achievement may be reflecting their biological substrates in the prefrontal cortex (Shamosh et al., 2008). Impulse inhibition and reward-delaying behavior have been associated with the functioning of prefrontal cortex and associated subcortical structures (Bunge & Zelazo, 2006; Shamosh et al., 2008). The

* Corresponding author. Tel.: +34 91 815 31 31x1644.
E-mail address: jhlozano@ucjc.edu (J.H. Lozano).

0191-8869/$ - see front matter © 2014 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.paid.2014.01.013

prefrontal cortex is also responsible for working memory capacity and abstract reasoning (Kane & Engle, 2002). Individual differences in the structure, development, and function of the prefrontal cortex, therefore, may well underlie the covariance among impulsivity, intelligence, and educational achievement.

1.2. The interaction hypothesis

Although many authors have postulated that personality and intelligence interact with each other to influence the development of knowledge and performance (Ackerman, 1996; Cattell, 1987; Chamorro-Premuzic & Furnham, 2006; Jensen, 1998; Matthews, 1999), empirical research in this regard has been rare. Nevertheless, recent studies have shown that the relationship between personality and academic achievement may be moderated by the individuals' level of ability (Beaujean et al., 2011; Heaven & Ciarrochi, 2012; Ziegler, Knogler, & Bühner, 2009).

Regarding the constructs of interest for this study, past and recent research suggest a moderator effect of intelligence on the relationship between impulsivity and academic performance (Kipnis, 1965; Kipnis & Resnick, 1971; Vigil-Colet & Morales-Vives, 2005). The relationship between impulsivity and academic performance seems to be much clearer for bright students than for less intelligent students, to the extent that, in certain instances, among less intelligent students the relationship does not hold (Kipnis, 1965; Kipnis & Resnick, 1971). Such a moderator effect has also been observed in discrimination learning performance (Lozano & Pérez, 2012). However, in this case, impulsivity seems to be detrimental to performance only in individuals with lower intelligence scores.

According to Vigil-Colet and Morales-Vives (2005), impulsivity may act as a moderator variable in the relationship between intelligence and achievement. Based on the investment theory (Cattell, 1987), impulsivity is supposed to moderate the way in which people invest their cognitive resources to produce achievements (see also Ackerman, 1996; Jensen, 1998). Such an approach have found support in studies in which measures of impulsivity showed higher correlation values with measures of crystallized intelligence (Gc) and academic performance than with measures of fluid intelligence (Gf) (Lynam et al., 1993; Vigil-Colet & Morales-Vives, 2005).

Nevertheless, the interaction hypothesis has not been adequately tested so far. To our knowledge, we do not know any study in which the interaction term between impulsivity and intelligence had been included in the analyses. Furthermore, most of the available studies suffer from some serious limitations derived from a bivariate approach based on the analysis of correlations. In this regard, the capacity of impulsivity to predict academic performance is rarely tested controlling for the effect of intelligence. The interrelations among the constructs may also be somewhat misrepresented because specific task variance. This may be especially critical in the case of measures of academic performance, which do not necessarily meet psychometric standards of reliability, validity, and absence of bias. Besides, measurement error becomes a major issue when it comes to detect moderator effects. Errors in measuring the predictors are exacerbated when they are multiplied to form a product term, which entails a drop in statistical power (McClelland & Judd, 1993). This kind of methodological problems can be ameliorated through a latent variable approach (Kenny & Judd, 1984).

1.3. The present study

The aim of the present study was to analyze the interrelationships between impulsivity, intelligence, and academic performance in university students, paying special attention to the potential interaction between impulsivity and intelligence in the prediction of academic performance. To that end, analyses were carried out at the latent level using structural equation modeling. Thus, the specific variance associated with the individual measures was removed, considering only the common variance underlying measures of the same construct. Such an approach derives in a decrease of measurement error and an increase in statistical power.

In light of all the above, the hypotheses for this study were as follows: (1) impulsivity is negatively correlated with intelligence and academic performance; (2) intelligence is positively correlated with academic performance; (3) impulsivity predicts academic performance significantly and independently of intelligence; and (4) impulsivity and intelligence interact with each other in predicting academic performance.

2. Method

2.1. Sample

The sample was comprised of a total of 174 Psychology undergraduates, 53 men (30.5%) and 121 women (69.5%). Participants ranged in age from 18 to 37 years-old (Women: $M = 20.407$, $SD = 3.211$; Men: $M = 21.600$, $SD = 4.086$). Participation in this study was among the activities of an academic course.

2.2. Materials

Barratt's Impulsivity Scale (*BIS-11*; Oquendo et al., 2001): Spanish adaptation of the Barratt's Impulsivity Scale. It is a 30-item questionnaire that measures three different components of impulsiveness: Motor Impulsiveness (BIS-M), which reflects the tendency to act without thinking; Cognitive Impulsiveness (BIS-C), characterized by making quick cognitive decisions on the spur of the moment; and Non-Planning Impulsiveness (BIS-NP), which reflects a present orientation and a lack of planning for the future. The reliability and validity of the BIS have been repeatedly demonstrated in a variety of languages (Fossati, Di Ceglie, Acquarini, & Barratt, 2001; Oquendo et al., 2001; Patton, Stanford, & Barratt, 1995; Someya et al., 2001).

Primary Mental Abilities (*Test de Aptitudes Mentales Primarias – PMA*; Thurstone & Thurstone, 1999): Spanish adaptation of the test developed by L. L. Thurstone. The test includes five subscales assessing several different abilities: Verbal (PMA-V), the ability to comprehend verbal statements; Spatial (PMA-S), the ability to reason about figural representations; Reasoning (PMA-R), the ability to identify patterns; Numerical (PMA-N), the ability to do relatively simple computations quickly; and Verbal Fluency (PMA-VF), the ability to produce simple words rapidly. The PMA has demonstrated adequate reliability (test–retest: .73 for PMA-S and PMA-VF; split-half: .91 for PMA-V, .92 for PMA-R, and .99 for PMA-N) and validity.

Academic performance (AP) was measured by the students' grades in four courses of the degree in Psychology: Psychometrics (AP-PS), Psychology of Attention (AP-AT), Psychology of Learning (AP-LE), and History of Psychology (AP-HI). These subjects were specifically chosen from the academic program according to the following criteria: (a) the subjects were compulsory, so that all participants should have done them; (b) the subjects corresponded to different domains, and required verbal (e.g., History of Psychology) as well as numerical (e.g., Psychometrics) abilities; (c) performance in the subjects was assessed based on continuous work throughout the course as well as procedural and theoretical examination; (d) the grades were exclusively based on individual performance; and (e) the percentage of missing values was below 10% for each subject.