The role of personality traits and intelligence in academic achievement of Russian high school students

Sergey Malykh*

Psychological Institute of Russian Academy of Education, 9, 4, Mokhovaya str., Moscow 125009, Russia

Abstract

The current study analyzed the role of ‘Big Five’ personality traits and non-verbal intelligence in the individual differences in academic achievement of high school students. The study involved 300 Russian high school students, including 148 girls and 152 boys (aged from 14.50 to 17.75 years). We analyzed the structure of the relationships between intelligence, personality traits and academic success using structural equation modeling. It was shown that Extraversion was negatively related to non-verbal intelligence whereas Openness to experience was positively related to it. In turn, non-verbal intelligence was associated with academic achievement. Conscientiousness was the only ‘Big Five’ trait which contributed to individual differences in academic achievement independent of the level of non-verbal intelligence.

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1. Introduction

Individual differences in academic success during the school period are reliable predictors of the quality of life in adulthood (Power et al., 2013). That is why the problem of predicting academic success does not lose its relevance for more than a century, and during that time different psychological constructs have been considered as predictors of success in learning (Malykh, Tikhomirova, 2015; Tikhomirova et al., 2015; Petrides et al., 2005).

* Corresponding author. Tel.: +7-903-740-44-16.
E-mail address: malykhsh@mail.ru

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One of the most important factors of individual differences in academic achievement is non-verbal intelligence (e.g., Kuncel et al., 2001). Strong positive relationship between non-verbal intelligence as measured with the Raven's Progressive Matrices and academic success based on school grades and standardized test tasks has been repeatedly reproduced in several studies and meta-analyses (Verbitskaya et al., 2015; Taub et al., 2008). In particular, the meta-analyses show that correlation rates between non-verbal intelligence and academic achievement range from 0.40 to 0.63 (Deary et al., 2007; Luo et al., 2006). Correlation varies in accordance with the method that was used to measure intelligence: it tends to be higher for the latent ‘g’ factor that sometimes correlates with performance (up to 0.81) (Deary et al., 2007). It was shown that at different school ages the strength of the relationship between intelligence and academic achievement varies from more pronounced at primary school age to less pronounced among high school students. For example, in Estonia intelligence plays the most important role in academic performance during the first school year ($r = 0.54, p < 0.01$), while for high school the correlation is lower ($r = 0.32, p < 0.01$) (Laidra et al., 2007).

A number of studies have shown that academic achievement is largely associated with personality traits contributing to successful academic performance (Laidra et al., 2008; Briley et al., 2014). At the same time, the direction and strength of these associations are not as clear as for non-verbal intelligence due to variability in the age of students, socio-economic status, and tests used for measurement. Some studies have found that among the ‘Big Five’ personality traits academic achievement is mostly associated with Conscientiousness (Barbaranelli et al., 2003), while others reported Openness to experience (Laidra et al., 2007).

According to studies, at least three of the ‘Big Five’ personality traits – Openness to experience, Neuroticism, and Extraversion – are related to non-verbal intelligence (see review Malykh, Tikhomirova, 2015). Moreover, Openness to experience and Conscientiousness are often considered as correlates of cognitive abilities (Chamorro-Premuzic, Furnham, 2004). These studies imply the existence of more complicated indirect relationships between the Big Five personality traits, non-verbal intelligence and academic achievement.

Thus, the aim of this study was to analyze the interrelationships between the Big Five personality traits, non-verbal intelligence and academic achievement in Russian high school students.

2. Methods

2.1 Participants

The study involved 300 Russian high school students of Grades 9, 10, 11 aged from 14.50 to 17.75 years, including 148 girls and 152 boys. The students were enrolled from a public secondary school in Moscow region. Written consent forms were obtained from parents of the students. Data collection was anonymous – each participant had a personal identification number.

2.2. Measures

2.2.1. Academic achievement

Academic achievement was indicated by annual grades in Math, Language and Science. Annual grades are given by teachers and vary from 2 (low achievement) to 5 (high achievement) points.

2.2.2. Personality traits

To assess personality traits we used the Russian version of the questionnaire NEO-PI-R standardized on the Russian population. Each of the 5 scales of this questionnaire corresponding to 5 basic personality dimensions comprises 6 subscales, each being assessed based on 8 questions. For the statistical analysis we used the scores for the five factors – Neuroticism, Extraversion, Openness to experience, Agreeableness and Conscientiousness.

2.2.3. Non-verbal intelligence

Non-verbal intelligence was measured with the ‘Raven Progressive Matrices’ test (RPM). It consists of 60 tasks grouped in 5 series. In series A, participants have to complement the missing part of an image. In series B they are asked to find correspondence between pairs. In series C the tasks are related to geometrical principles in figure changes. In series D the participants have to find the structure in shuffling of figures. Series E requires the ability to
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