

The Intelligence as a Mediator between Individuality Traits and Divergent Thinking in Russian Students

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Abstract: Most studies of the relationship between intelligence and divergent thinking and between personality and divergent thinking put in examination singly. Apparently, an integration of intelligence and personality would lead to finding a common source of their shared effects on divergent thinking. 425 undergraduate students at universities of Perm city (Russia) took part in this study. There were 298 women and 127 men aged 17 to 22 years. Three levels of the individuality traits were specified: the nervous system, the temperament, and the personality traits. The nervous system variables were measured by the Pavlovian Temperament Survey, the temperament by the Formal Characteristics of Behaviour – Temperament Inventory, the personality traits by the Big Five Inventory-2. Path models from individuality traits to fluid and crystallized intelligence to divergent thinking were tested in which the individuality traits were exogenous variables, the fluid and crystallized intelligences mediators, and the divergent thinking composite index the endogenous variable. Direct effects of the individuality traits on the divergent thinking were as follows. Nervous system and temperament traits produced no significant effects on the divergent thinking. Of the personality traits, Open-Mindedness, Conscientiousness, and Extraversion scores provided significant effects on the divergent thinking. When the individuality traits of different levels were combined, the Open-Mindedness and Agreeableness scores only revealed significant effects on the divergent thinking. The crystallized intelligence, in contrast to the fluid intelligence, mediated the specific indirect effects of some individuality traits on the divergent thinking. The total indirect effect of the individual traits through the fluid and crystallized intelligences as mediators on the divergent thinking was higher than that of the crystallized intelligence alone. When the individual traits of several levels were involved together in the model, the multileveled structure of the individuality traits was adjusted.

Keywords: individual traits, fluid intelligence, crystallized intelligence, divergent thinking, creativity

Introduction

Divergent thinking is a theoretical, objective and operational construct of creativity. It estimates and reconciles opposite forms of creative thinking (Acar et al., 2019). Seminal works of Guilford (1968) and Wallach and Kogan (1965) laid the foundation of a huge ensuing amount of research on divergent thinking (DT), as well as assessing parts of intelligence and individual traits to DT. The study of intellectual and personal characteristics related to creativity is one of the main areas of research in this field (Batey, Chamorro-Premuzic & Furnham, 2009; Batey & Furnham, 2006). Some studies examined the cumulative effect of intelligence and personality on creativity. The obtained results were ambiguous. For example, in the Furnham & Bachtiar (2008) research crystallized intelligence was significantly related to creativity, but none of the traits of the Big Five were found to be significantly related to creativity. Other studies have found that both personality and intelligence significantly relate to creativity (e.g., Batey, Chamorro-Premuzic & Furnham, 2009; Furnham & Bachtiar, 2008). Nevertheless, most studies of the relationship between intelligence and creativity (e.g., Benedek, Jauk, Sommer, Arendasy & Neubauer, 2014; Sternberg & O'Hara, 1999) and between personality and creativity (e.g., Eysenck, 1995; McCrae, 1987; Moutafi, Furnham & Tsousis, 2006; Simonton, 1999) put in studies singly.



Apparently, an integration of intelligence and personality would lead to finding a common source of their shared effects on DT. This theoretical issue is so far examined poorly. Its operational definition and measurement do not clear to some extent, as well. Thus, how personality, intelligence and DT operate jointly is an issue which remains poorly examined.

The background of the current study is based on psychological theories of Russians Volf Merlin (1986) and Dmitry Ushakov (2011). Merlin developed the theory of integral individuality. It uses a multileveled principle. In particular, it specifies personality, temperamental, and nervous traits and consider them at different levels. They are both autonomous relatively and interrelated in a polymorphous way. Ushakov developed the structure-dynamic theory of intelligence and creativity, as well as their development in ontogenesis. This theory emphasizes links between intelligence and creativity with personality traits, high motivation to achievement, self-efficacy, and success. A unique configuration of personality traits should provide high intellectual and creative products.

We propose a cross-theoretical approach which suggests combining analytically the theories of Merlin and Ushakov. They were a theoretical basis to empirically study an investment of individuality traits and intelligence in DT. The second issue is to consider and convert intelligence and individuality traits effects on DT operationally. One can see there is a number of respective but various operational definitions. In this study, we reduce them to models in such a way: the intelligence is a mediator variable between individuality traits of several levels and DT. The main premise was that individuality traits provide both direct (passing intelligence variables) and indirect (through intelligence variables) investment in DT. The tasks of this study were as follows. 1. To examine whether personality, temperamental, and nervous traits enable DT (direct effects). 2. To examine whether fluid and crystallized intelligences enable DT. 3. To examine whether individuality traits through fluid and crystallized intelligences enable DT (indirect effects).

Method

Participants

425 undergraduate students at universities in Perm city (Russia) took part in this study. There were 298 females and 127 males aged 17 to 22 years ($M = 18.6$, $SD = 0.9$).

Measures

Three levels of the individuality traits were specified: the nervous system, the temperament, and the personality traits. The nervous system variables were measured by the Pavlovian Temperament Survey (Strelau, Angleitner, & Newberry, 1999; Russian adaptation: Danilova & Shmelev, 1988), the temperament by the Formal Characteristics of Behaviour – Temperament Inventory (Strelau & Zawadzki, 1995; Russian adaptation: Strelau et al., 2009), the personality traits by the Big Five Inventory-2 (Soto & John, 2017; Russian adaptation: Shchebetenko et al., 2020). DT was assessed by Alternate Uses test (Wallach & Kogan, 1965; Russian adaptation: Averina & Shcheblanova, 1996). Fluid intelligence was measured by the Raven's Progressive Matrices (Raven, Raven, & Court, 2012) and crystallized intelligence by the Universal intelligence test (Baturin & Kurganskiy, 1995).

Statistical Analysis

All analyses were performed using SPSS v. 22.0 and SPSS AMOS v. 22.0. Path models tested paths from the individuality traits to DT (direct effects), as well as from fluid and crystallized intelligences to DT (direct effects). In multiple mediator models, the individuality traits were exogenous variables, fluid and crystallized intelligences entered mediators, and the composite DT index was an endogenous variable. Multiple mediator models tested indirect effects of the individual traits through mediators on DT. The model fit indices included the chi-square statistic, the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA). A bootstrap technique (the bias-corrected bootstrap confidence interval, bc.bci95%) was in use to assess indirect effects.

Results

Nervous system and temperament scores produced no significant direct effects on DT. Of the personality traits, open-mindedness, conscientiousness, and extraversion scores provided significant direct effects on DT ($\beta_1 = 0.12$, $p < 0.016$; $\beta_2 = -0.12$, $p < 0.019$; $\beta_3 = 0.11$, $p < 0.036$; respectively). Open-mindedness and agreeableness scores showed significant direct effects on DT ($\beta_1 = 0.16$, $p < 0.001$; $\beta_2 = -0.12$, $p < 0.011$; respectively). The fluid intelligence produced no significant direct effects on DT. In contrast, the crystallized intelligence score demonstrated a significant direct effect on DT ($\beta = 0.16$, $p < 0.001$). When both kinds of intelligence entered in the model, only the crystallized intelligence score revealed a significant direct effect on DT ($\beta = 0.14$, $p < 0.006$).

When individual traits of different levels entered together in the model, fluid and crystallized intelligences were mediators, its fit indices were as follows: $\chi^2(107) = 368.63$, $p < 0.001$, CFI = 0.928, RMSEA = 0.076. The following results were obtained. The fluid intelligence as a mediator was non-significant. Use of the crystallized intelligence as a mediator led to some significant results. Among nervous system traits, the excitation score was significant ($ab = 0.025$, $bc.bci95\% [0.004; 0.061]$). Among temperament traits, the activity score was significant ($ab = -0.024$, $bc.bci95\% [-0.057; -0.004]$). Among personality traits, the conscientiousness score was significant ($ab = -0.024$, $bc.bci95\% [-0.056; -0.004]$) and the open-mindedness score was significant ($ab = 0.022$, $bc.bci95\% [0.003; 0.051]$).

The total indirect effect (the sum of indirect effects mediated by fluid and crystallized intelligences together) of the individual traits of different levels together on DT was significant and higher than the specific indirect effect of crystallized intelligence alone: for excitation score the total indirect effect was $ab = 0.020$, $bc.bci95\% [0.001; 0.005]$, for activity score – $ab = -0.024$, $bc.bci95\% [-0.057; -0.002]$, for conscientiousness score – $ab = -0.026$, $bc.bci95\% [-0.055; -0.004]$, for open-mindedness score – $ab = 0.024$, $bc.bci95\% [0.005; 0.052]$.

Conclusions

The main obtained results were as follows. Crystallized intelligence, in contrast to fluid intelligence, mediated the specific indirect effects of some individual traits on DT. The total indirect effect of fluid and crystallized intelligence was significant and higher than that of crystallized intelligence alone. When individual traits of several levels entered together in the model, the multileveled structure of the individual traits was adjusted.

The results obtained can be used in the pedagogical process to develop students' divergent (creative) thinking. Solving this problem, favorable factors are the individual traits of different levels, fluid and crystallized intelligences. However, notice that some individual traits contribute to, and others, on the contrary, inhibit divergent thinking, crystallized intelligence makes a greater contribution to divergent thinking than fluid intelligence, individual traits of different levels, fluid and crystallized intelligence make joint contributions to divergent thinking.

Notes

The study was funded by RFBR, project number 19-29-07046.

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