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Moderating effect of self-determination in the relationship between Big Five personality and academic performance

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ABSTRACT

Previous studies have shown that both personality and motivation are important factors in student academic performance. This study examined how the interactions between the Big Five personality traits and self-determination motivation orientations affect students' academic performance. The hypotheses were empirically tested using cross-sectional data collected from 249 primary school students in China. The correlation analysis found that self-determined motivation and four of the five personality traits (not emotional instability) were significantly positively related to academic performance in English. The hierarchical regression analysis revealed that, after controlling for gender, openness to new experience and conscientiousness both positively predicted English performance. Significant interaction effects were found between agreeableness and self-determined motivation, and between conscientiousness and self-determined motivation. However, conscientiousness and agreeableness only positively predicted academic performance when the student's self-determined motivation was low.

1. Introduction

Research on motivation and its relationship to academic performance is as vibrant and influential as ever. As a key determinant of academic performance, academic motivation has consistently been shown to make a positive contribution to academic achievement (Richardson, Abraham, & Bond, 2012). Recently, researchers have focused on the effect of other non-cognitive constructs, such as personality traits, on academic performance (Zuffianò et al., 2013), as previous studies have shown that learners' motivation, skills, and abilities do not fully explain student achievement. This study investigated whether variation in students' personality traits could be used to explain differences in academic achievement and how these personality traits interacted with motivational constructs.

2. Personality and academic performance

Personality is defined as "an individual's characteristics patterns of thought, emotion, and behavior, together with the psychological mechanisms – hidden or not – behind those patterns" (Funder, 1997, p. 2). This definition describes the motivational control that influences a person's behavior (Barrick, Mount, & Li, 2013). For example, Deci and Ryan (1985) posited that students who were intrinsically motivated to learn displayed different personality traits, such as intellectual curiosity and the tendency for disengagement, than students who were extrinsically motivated to learn. This suggests that personality traits could be a promising predictor of academic outcomes.

The Big Five model broadly classifies human personalities into five major traits: extraversion (sociable, active), openness (imaginative, intellectual), conscientiousness (persistent, dependable), emotional instability (anxious, unconfident), and agreeableness (cooperative, friendly) (Barrick & Mount, 1991). Each of these traits has been examined in terms of its relationship to academic achievement. Recent meta-analyses have found that conscientiousness has the strongest correlation with GPA (Richardson et al., 2012). Students who are conscientious tend to make plans, regulate their behavior in accordance with their plans, and make efforts to implement their plans. As a consequence, they are more likely to perform better at school (Caprara, Vecchione, Alessandri, Gerbino, & Barbaranelli, 2011). In comparison, inconsistent associations were found between openness, agreeableness, emotional instability, and extraversion and academic success.

3. Self-determination and academic performance

The Self-determination Theory (SDT; Ryan & Deci, 2000) distinguishes the different reasons for task engagement. Tasks that are performed for the pleasure inherent in the task are associated with autonomous motivation, whereas tasks that are engaged in for instrumental or external reasons are linked to controlled motivation (DeCharms, 1968). SDT proposes that motivation falls along a continuum of relative autonomy, with external forms of regulation at one end and internal forms of regulation at the other (Ryan & Lynch, 2003).

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There are four types of extrinsic regulation ranging from least to most autonomous: external (i.e., for the reward), introjected (i.e., to avoid guilt), identified (i.e., for the inherent value of the task), and integrated (i.e., the external reasons for performing the task have been internalized). These forms of regulation represent different degrees of internalization (Gagné & Deci, 2005); once the motivation is completely internalized, the individual achieves intrinsic motivation and feels competent and autonomous (Richardson et al., 2012).

It is noteworthy that in SDT, autonomy is not equal to independence or uniqueness which is typically underemphasized in collectivist societies. Instead, it reflects an intrapersonal experience of volition and choice, which has been proved to be beneficial for well-beings across cultural groups (Downie, Koestner, ElGeledi, & Cree, 2004; Vansteenkiste, Zhou, Lens, & Soenens, 2005). Most studies have found that autonomous motivations (e.g., intrinsic, integrated, identified regulation) lead to higher achievement than controlled motivations (e.g., external, introjected) (Sturges, Maurer, Allen, Gatch, & Shankar, 2015). As autonomously motivated individuals are connected to their "core self" and determine their values and behavior according to that self, they have increased self-awareness (Deci & Ryan, 1985) and self-control (Inzlicht & Legault, 2014), which helps learners to monitor their learning and achieve academic success.

4. Self-determination as a moderator

The inconsistent findings regarding the relationships between the Big Five personality traits and academic performance could be due to the presence of confounding variables. Phillips, Abraham, and Bond (2003) argued that motivation affects the personality–academic performance relationship. Autonomous motivation is jointly determined by an individual's personality traits and the environmental context in which he or she is situated (McCrae & Costa, 2008). Some researchers have argued that personality traits might be more useful predictors of human behavior when more autonomy is experienced (e.g., Lee, Ashford, & Bobko, 1990). Indeed, research has shown that motivation moderates the relationship between personality traits and work performance (Barrick, Parks, & Mount, 2005); however, few studies have examined how these two sets of constructs interact to affect student learning. Most relevant to the current study was Di Domenico and Fournier's (2015) observation of the interaction between personality and motivation. Conscientiousness was found to be a stronger predictor of Canadian undergraduates' GPA at lower levels of autonomous motivation, suggesting that an industrious disposition served a compensatory function among students with low autonomy. In the examination of undergraduates' creativity performance, Sung and Choi (2009) observed that extrinsic motivation emerged as a moderator in the agreeableness–creativity relationship as well as openness–creativity relationship. Specifically, agreeableness only showed significant relationship with creative performance when extrinsic motivation was low, whereas openness showed significant relationship with creative when extrinsic motivation was high. Altogether, the above limited evidence suggests a moderating effect of motivation between personality and task performance.

5. Present research

Although recent research has demonstrated the utility of using personality traits to predict academic performance, relatively little is known about the mechanisms through which personality traits affect academic performance. Given the long-standing interest in the role of personality and motivation in academic learning, and the uncertainty about the links between some personality traits and academic achievement, this study assessed the role of cognitive motivational processes in the relationships between personality traits and academic performance in English. The choice of English as the learning outcome measure was based on Ehrman's (2000) concern that motivation, as a highly complex factor in second language learning, needs to be considered in the light of non-affective variables, such as personality type. Also, the nature of language learning is very much concerned with expressing oneself, communicating ideas, and experiencing different cultures, all of which would favor students who are extraverted, agreeable, and open to new experiences. Hence, this study examined whether the interactions between the Big Five personality traits and self-determined motivation affected English performance of primary school children. Specifically, the following hypotheses were developed based on the above discussion.

H1. Agreeableness is a significant positive predictor of academic performance.

H2. Openness is a significant positive predictor of academic performance.

H3. Conscientiousness is a significant positive predictor of academic performance.

H4. Emotional instability is a significant negative predictor of academic performance.

H5. Extraversion is a significant positive predictor of academic performance.

H6. Self-determined motivation will moderate the relationships between the Big Five personality traits and academic performance such that the relationships will be stronger when the degree of self-determined motivation is higher.

6. Method

6.1. Participants and procedure

Two hundred and forty-nine fifth-grade students from two public schools in mainland China participated in this study; 46.0% were males and the mean age was 11.56 years ($SD = 0.59$). The removal of 10 students due to invalid data (duplicate answers to the same survey question) and 33 due to missing data reduced the final sample size to 206. All of the students participated on a voluntary basis, with no compensation. They completed the questionnaires in their regular school classrooms during regular class hours. After the students were briefed on the purpose of the study and their right to withdraw from the study at any time, they completed the survey package under the supervision of the classroom teachers and the research assistant. The questionnaires were translated from English to Chinese by the first author. Bilingual, Chinese–English speakers did the back-translations, during which minor modifications were made to the wording of some items to make it more suitable for Chinese primary school students.

6.2. Measures

Twelve items identifying the reasons children learn English were adapted from Ryan and Connell's (1989) Academic Self-Regulation Questionnaires (SQR-A). This questionnaire was developed for students in late elementary and middle school to measure their regulatory style. There were three items for each regulatory style: intrinsic motivation, identified regulation, introjected regulation, and external regulation. The participants were instructed to indicate their agreement with each item on a 5-point Likert scale ranging from 1 (Not at all true) to 5 (Totally true). The reliability and validity of the SQR-A instrument for Asian samples has been established with satisfactory internal consistency and construct validity (d'Ailly, 2003; Zhou, Ma, & Deci, 2009). In this study, the four-factor scale showed good validity with a good model fit after one external regulation item was deleted due to its poor factor loading ($\chi^2 = 61.86$, $\chi^2/df = 1.63$, IFI = .97, CFI = .97, RMSEA = .055); the scale also had acceptable reliability coefficients (ranging from .60 to .86). The Relative Autonomy Index (RAI, Connell & Ryan, 1986) was computed to indicate students' level of autonomy

with the subscale score for each subscale, following the following formula. This technique has been used in past studies with Chinese samples (e.g., Bao & Lam, 2008; Vansteenkiste et al., 2005).

2 x Intrinsic + Identified − Introjected − 2 x External

The 15-item questionnaire for measuring the Big Five personality traits in late childhood was adapted from Caprara et al.'s (2003) *Big Five Questionnaire—Children version (BFQ-C)*. It assesses the five major domains of personality: extraversion, agreeableness, openness to new experiences, conscientiousness, and emotional instability. Recent research (Caprara et al., 2011; Zuffianò et al., 2013) provided evidence for the internal consistency and validity of this scale. This five-factor scale showed good validity with an acceptable model fit with the current sample ($\chi^2 = 171.62$, $\chi^2/df = 2.15$, IFI = .90, CFI = .90, RMSEA = .075) and reliability coefficients (ranging from .60 to .73).

The participants were also required to report the scores of their latest English test to assess their academic achievement, as it was impractical under the local policies to obtain school transcripts or exam records for the participants.

7. Results

Tests of the skewness and kurtosis indices for all of the main variables under investigation revealed non-significant departures from normality (skewness and kurtosis values were all between −1 and +1). To reduce the multicollinearity between the main effect variables and their interaction terms, the scores of the Big Five personality and self-determination variables were mean-centered, given the strong zero-order correlations among some of the studied variables. The descriptive statistics, intercorrelations, and reliability coefficients for the measures are shown in Table 1. The self-determination index and the personality variables, except for emotional instability, were moderately positively associated with English performance. Students' gender was not associated with personality variables or RAI, but was negatively correlated with English performance ($r = -.18$, $p < .05$), suggesting that female students in general outperformed males in the English test. Age was not related to any other variables. Accordingly, gender was statistically controlled for in all subsequent analyses.

Hierarchical regression analyses were conducted with English test scores as the dependent variable to examine how self-determination moderated the relationship between personality traits and academic performance (Baron & Kenny, 1986). The analysis assessed the incremental explanatory power of the variables in each block. The variables were entered into the hierarchical regression model in the following order. After controlling for gender in block 1 of the hierarchical regression, the five personality variables and RAI were entered in block 2 to test their incremental predictive validity over gender. The five interaction terms of RAI and personality traits were added in block 3. According to Baron and Kenny (1986), a significant moderator effect is indicated by significant incremental variance in the dependent variable after the interaction terms are added to the regression equation. Partial F-tests were used to determine whether progressively complex models explained significantly greater amounts of variance in English performance.

Table 2 shows that in Step 1, gender was a significant predictor of English performance (ß = −.18, p < .05). In Step 2, of the five personality variables, conscientiousness and openness to experience were significantly related to English performance (ß = .19, p < .05 and ß = .27, p < .01, respectively). However, the effects of other personality variables on English performance were not significant. A partial F-test comparing the models at Steps 1 and 2 showed that the personality and self-determination variables evidenced incremental predictive utility over and above gender ($\Delta R^2 = .25$, $F(7, 198) = 10.80$, $p = .000$). The final model at Step 3 indicated a significant RAI × Agreeableness interaction (ß = .17, p < .05) and a significant RAI × Conscientiousness interaction (ß = −.21, p < .01). All of the other interaction terms were not significant. A partial F-test found that the model at Step 3 explained significantly more variance than the model at Step 2 ($\Delta R^2 = .05$, $F(12, 193) = 7.78$, $p = .016$). The addition of the interaction terms accounted for an additional 5% of the variance in students' English performance.

To specify the interaction patterns, the significant interaction effects were plotted by simple slopes of English scores at high (+1 SD) and low (−1 SD) levels of personality variables and self-determined motivation (Aiken & West, 1991). The interaction patterns for agreeableness and conscientiousness are depicted in Figs. 1 and 2. Fig. 1 suggests that at low levels of student-reported self-determined motivation, there was a significant and stronger positive relationship between conscientiousness and English performance ($t = -2.58$, $p < .05$). However, at high levels of self-determined motivation, the relationship between conscientiousness and English performance was non-significant. In a similar vein, Fig. 2 suggests a significant and strong positive relationship between agreeableness and English performance only for students with low self-determined motivation ($t = -2.25$, $p < .05$). In other words, for students with low self-determination, both agreeableness and conscientiousness were positively related to academic performance. In contrast, for students with high levels of self-determination, agreeableness or conscientiousness did not show any meaningful relationship with academic performance.

8. Discussion

The present study examined the interactive effects of personality and self-determined motivation on the academic performance of Chinese primary school students. Building on past research that suggested that the interactions between personality and performance were moderated by motivation (Di Domenico & Fournier, 2015), this study explored the potential role of self-determined motivation as an intervening variable (moderator) in the personality–performance relationship.

Although the correlational results accorded well with studies documenting the positive role of personality in learning (Steele-Johnson & Leas, 2013), the regression results indicated that only conscientiousness and openness to new experience made significant contributions to learning outcomes before the moderating effect of motivation was considered. This suggested that students who were disciplined, organized,

Table 1
Descriptive statistics, zero-order correlations, and reliability coefficients for the study variables (N = 206).

Variables	Mean	SD	Alpha	1	2	3	4	5	6	Gender	Age
1. RAI	.46	2.56	.60 to .86	–						−.09	−.02
2. Agreeableness	4.15	.84	.68	.20**	–					−.08	−.09
3. Openness	3.93	.78	.73	.33**	.57**	–				−.09	−.05
4. Conscientiousness	4.05	.70	.71	.31**	.67**	.67**	–			−.10	−.06
5. Emotional instability	2.61	.85	.60	−.06	−.07	−.00	−.09	–		.03	−.07
6. Extraversion	3.65	.84	.62	.13	.37**	.44**	.34**	.24**	–	.01	.04
7. Test score	79.08	16.95	–	.25**	.32**	.47**	.43**	.01	.30**	−.18**	−.04

Note: **p < .01.

Table 2
Hierarchical regressions of achievement predictors (N = 206).

Predictors	Standardised coefficients		
	Step 1	Step 2	Step 3
Step 1	−.18*		
Gender			
Step 2			
Gender		−.14*	
Agreeableness		−.03	
Openness		.27***	
Conscientiousness		.19*	
Emotional instability		.01	
Extraversion		.11	
RAI		.08	
Step 3			
Gender			−.17**
Agreeableness			.01
Openness			.26**
Conscientiousness			.13
Emotional instability			.02
Extraversion			.09
RAI			.10
RAI × agreeableness			.19*
RAI × openness			−.04
RAI × conscientiousness			−.22*
RAI × emotional instability			−.01
RAI × extraversion			−.13
R^2	.026	.251	.284
R^2 change	.031*	.246***	.050*
F	6.45***	10.80***	7.78***

Notes: *p < .05; **p < .01; ***p < .001.

persistent, hardworking, open-minded, and intellectually curious were most likely to do well in school. This result strengthens the claim that factors explaining academic achievement go beyond IQ and cognitive ability (Conard, 2006). Some literature documented the motivational roots in extraversion — extraverted individuals are primarily motivated by the desire to excel and receive rewards (Lucas, Diener, Grob, Suh, & Shao, 2000), which is well captured by the idea of external regulation in SDT. However, the missing association between extraversion and academic performance in this study seems to suggest that extraversion may only act as an antecedent of external motivation, with the latter being the key determinant of learning outcomes (Komarraju, Karau, & Schmeck, 2009).

Second, the regression analysis partially supported the idea that self-determination moderates the association between personality and academic performance, indicating that although personality and self-determination are not independent predictors of academic performance, in combination they can predict academic performance. This

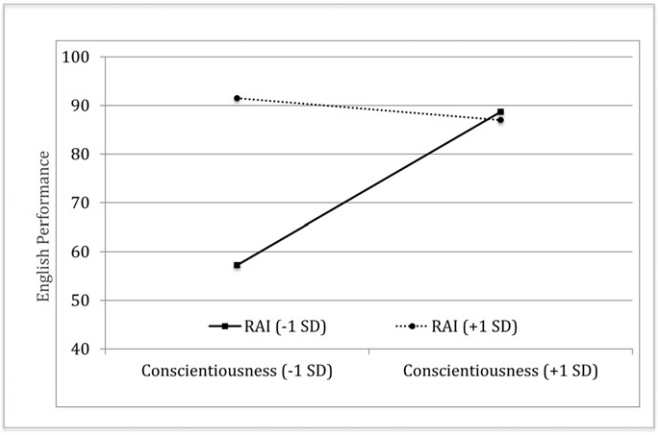

Fig. 1. Predicted English performance across levels of self-determination and conscientiousness.

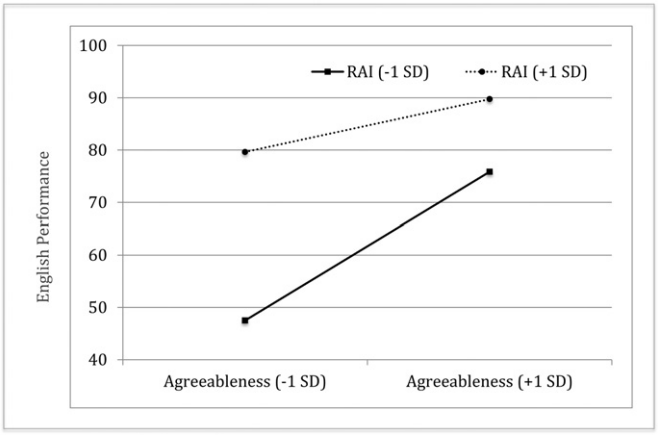

Fig. 2. Predicted English performance across levels of self-determination and agreeableness.

finding is in line with Di Domenico and Fournier's (2015) observation that conscientiousness and autonomous motivation interactively affected student academic performance. However, this study expanded the range of examined personality variables by testing all five personality variables and found a similar interactive pattern for agreeableness. Therefore, certain personality traits (e.g., conscientiousness and agreeableness) perform a compensatory function for students with lower levels of self-determined motivation. This finding implies that although all students gain from being agreeable and conscientious, the influence of these personality traits on academic performance is stronger for students with lower levels of self-determination. It is possible that highly motivated students are able to monitor and control their learning (Mega, Ronconi, & De Beni, 2014), and can obtain a higher academic performance whether or not they are hardworking (as reflected in conscientiousness) or are cooperative or socially skilled (as reflected in agreeableness). In other words, when they are capable of regulating their learning processes, higher scores in school tests are ensured. In contrast, when students are not very motivated, their personality makes a great difference to their learning performance. Students who are self-disciplined and curious to learn by nature could easily outperform those who are not organized or not interested in new experiences.

The interpretation of the above findings is subject to some limitations. First, as the current study was based on students enrolled in public primary schools in China, the results may not be generalizable to students in other countries or grade levels. Second, the accuracy of self-reported exam scores may be questionable due to the pressure of social desirability (Nancarrow & Brace, 2000) or reconstructive memory (Willard & Gramzow, 2008). Although past studies have reported relatively high correlations between self-reported and actual test scores (Kuncel, Crede, & Thomas, 2005), non-perfect correlations still indicate some levels of attenuation due to unreliable reporting (Creswell & Garrett, 2008). Hence, studies based on self-reported data should be interpreted with caution due to the unknown amount and source of errors in the dataset (Kuncel et al., 2005). Third, the reliability coefficients of some scales were merely modest (below .70), although past studies with Asian samples also reported less desirable reliability estimates (e.g., Mak & Tran, 2001; Ward, Leong, & Low, 2004). This deserves further examination in future research. Finally, due to its exploratory nature, this study did not mask the possibility that motivation acts as mediator in the personality–achievement relationship or that personality serves as a moderator in the motivation–achievement relationship (De Feyter, Caers, Vigna, & Berings, 2012). The cross-sectional design did not provide a definite answer to this question. Experimental studies that systematically examine students with different personality traits and levels of motivation in pre-designed learning environments would be an important future research direction.

9. Conclusions and implications

Despite these limitations, this study offers significant new insights into our understanding of the influence of personality on academic achievement. It documents the precise interactions between personality traits and student motivation that can predict academic achievement, indicating that the academic achievements of students with lower levels of self-determination are more dependent on personality traits than those of their highly motivated and self-determined counterparts. This has two important implications for teaching practices.

First, promoting students' autonomous motivation is critical. The experience of making choices promotes their sense of ownership of student leaning. There has been considerable progress in promoting self-determination in students in recent years. Many curricular and instructional models with this instructional focus have been introduced, such as the Self-Determined Learning Model of Instruction (Wehmeyer, Palmer, Agran, Mithaug, & Martin, 2000), and Project PARTnership Core Course (Harris & McKinney, 1993). Such models or programs position students in the center who are actively involved in negotiating the setting of workload, types of learning activities, or even assessment tasks, which exerts a positive influence on students' self-determination.

Second, students are not homogenous in their levels of academic motivation or in their personalities (Komarraju & Karau, 2005). Continuous monitoring of student personality traits, possibly through the use of class observation and feedback assessments, is also necessary, especially when teachers deal with students with low motivation. Knowing students' personalities can help educators incorporate appropriate strategies into the existing curricula to enhance student learning experience. For example, a teacher could reward a student by identifying him or her as a model student who is self-disciplined, organized, and hard-working. The teacher could also encourage students to work in groups to nurture the qualities of agreeableness.

In conclusion, this study documented some significant relationships between personality, self-determined motivation, and academic achievement. It extends our understanding of the important role of personality traits and motivation in explaining achievement, and lays a good foundation for further research on this topic. Future research could extend these findings by considering other individual difference variables that might moderate the relationships between personality traits and achievement, such as learning approaches, cognitive styles, self-efficacy, or the need for cognition.

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