The Big Five personality traits, learning styles, and academic achievement

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ABSTRACT

Personality and learning styles are both likely to play significant roles in influencing academic achievement. College students (308 undergraduates) completed the Five Factor Inventory and the Inventory of Learning Processes and reported their grade point average. Two of the Big Five traits, conscientiousness and agreeableness, were positively related with all four learning styles (synthesis analysis, methodical study, fact retention, and elaborative processing), whereas neuroticism was negatively related with all four learning styles. In addition, extraversion and openness were positively related with elaborative processing. The Big Five together explained 14% of the variance in grade point average (GPA), and learning styles explained an additional 3%, suggesting that both personality traits and learning styles contribute to academic performance. Further, the relationship between openness and GPA was mediated by reflective learning styles (synthesis-analysis and elaborative processing). These latter results suggest that being intellectually curious fully enhances academic performance when students combine this scholarly interest with thoughtful information processing. Implications of these results are discussed in the context of teaching techniques and curriculum design.

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1. Introduction

The quality of students' thoughts is critical to learning and could potentially determine their academic achievement. College students differ in how they process, encode, recall, organize, and apply the information they learn; some are thoughtful learners and others process information more superficially. Are these individual differences in preferred learning strategies and depth of information processing related to personality? Do learning strategies mediate the link between personality traits and academic achievement? We attempted to answer these questions by investigating the relationships between personality traits, learning styles, and academic achievement among college students.

2. Relevant prior research

2.1. Big Five

The Big Five framework of personality traits (Costa & McCrae, 1992) has emerged as a robust and parsimonious model for understanding the relationship between personality and various academic behaviors (Poropat, 2009). Conscientiousness is exemplified by being disciplined, organized, and achievement-oriented.

Neuroticism refers to degree of emotional stability, impulse control, and anxiety. Extraversion is displayed through a higher degree of sociability, assertiveness, and talkativeness. Openness is reflected in a strong intellectual curiosity and a preference for novelty and variety. Finally, agreeableness refers to being helpful, cooperative, and sympathetic towards others. There is some evidence that personality and motivation are intricately tied with individual differences in learning styles, and it is recommended that educators go beyond the current emphasis on cognition and include these variables in understanding academic behavior (Miller, 1991).

2.2. Learning styles

In addition to personality, learning styles are an individual difference factor that represents enduring and stable approaches to processing information (Snyder, 2000). Although there are several conceptual models of learning styles, we adopted Schmeck, Ribich, and Ramanaiah's (1977) model because it identifies learning strategies that are likely to enhance learning and academic achievement from the framework of effective information processing. This model adopts the view that memory is a by-product of careful thinking and depth of processing (Craik & Lockhart, 1972). In addition, rather than attempting to classify learners into mutually exclusive categories, this framework suggests that students tend to adopt either agentic/shallow processing (with the performance goal of doing well on a test) or reflective/deep processing (with the mastery goal of deep understanding and long-term retention). What

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students remember is a function of how they process information from lectures, readings, or discussions. Thus, students who are encouraged to think more deeply about the information are likely to encode information more thoroughly and remember it longer. Depth of processing also has clear implications for personality, and especially openness, making it a promising candidate for mediating relationships in the current research.

Of the four learning styles, synthesis-analysis refers to processing information, forming categories, and organizing them into hierarchies. Elaborative processing refers to connecting and applying new ideas to existing knowledge and to the learner's personal experiences. Methodical study consists of what is traditionally emphasized in most academic environments, such as being careful and methodical while completing all assignments on time. Fact retention involves processing information so that the main ideas are memorized with the goal of doing well on tests rather than understanding the meaning of what is being learned.

Prior research suggests that individuals differ in their intellectual styles and preferences for how they gain knowledge (Sternberg & Zhang, 2001; Zhang, 2003). For example, students tend to utilize more complex strategies invoking deep processing as they progress from the freshman to the senior level (Bartling, 1988; Jakoubek & Swenson, 1993).

2.3. Learning styles and personality

Evidence also suggests complex links between learning styles and personality traits. For instance, relative to shallow processors, deep processors are more likely to use appropriate study methods, draw conclusions effectively, and have a stronger internal locus of control (Gadzella, Ginther, Masten, & Guthrie, 1997). Deep processors are also more likely to be conscientiousness, intellectually curious, extraverted (Furnham, 1992; Zhang, 2003), and emotionally stable (Geisler-Brenstein, Schmeck, & Hetherington, 1996). Finally, students who prefer a structured learning environment and intuitive processing are prone to anxiety and worry (Zhang, 2003), whereas those preferring an activist and pragmatist style are more extraverted (Furnham, 1992). Thus, learning styles and personality traits appear to be intricately connected, although how they jointly influence academic achievement is unclear.

2.4. Personality and academic achievement

Personality traits also influence academic achievement. For instance, conscientiousness has consistently emerged as a stable predictor of exam performance (Chamorro-Premuzic & Furnham, 2003) and GPA (Conard, 2006). Combinations of Big Five traits have also been found to predict various educational outcomes. Namely, conscientiousness and openness predict course performance (Paunonen & Ashton, 2001), and agreeableness, conscientiousness, and openness predict overall academic performance (Farsides & Woodfield, 2003; Poropat, 2009). Extraversion, openness, and conscientiousness have also been found to predict GPA, especially when students apply previously accumulated knowledge to real life settings (Lievens, Ones, & Dilchert, 2009). In contrast, neuroticism or emotional instability is negatively associated with academic achievement (Chamorro-Premuzic & Furnham, 2003). In addition to the Big Five, other traits such as grit or perseverance (Duckworth, Peterson, Matthews, & Kelly, 2007) are also predictive of academic performance. Although these findings confirm the general significance of personality traits, there remains a need to examine other individual level factors such as students' learning styles.

2.5. Learning styles and academic achievement

Students differ in their preferred styles of thinking, processing information, and acquiring knowledge (Schmeck, 1999; Zhang, 2003). Some favor agentic styles, such as methodical study and fact retention, that are most suitable for obtaining higher grades, whereas others employ reflective styles, such as synthesis-analysis and elaborative processing, that are conducive to greater understanding and knowledge (Schmeck et al., 1977). A number of studies suggest that these individual differences in learning styles are predictive of student performance (Lockhart & Schmeck, 1984). Overall, the learning strategies most beneficial to course performance and cumulative GPA include active thinking and organized studying (Entwistle & Waterston, 1988), synthesis-analysis (Miller, Alway, & McKinley, 1987), deeper levels of reflection (Jakoubek & Swenson, 1993), and elaborative processing (Hall, Hladkyj, Perry, & Ruthig, 2004). Deep processors also appear to accrue other benefits, such as a learning goal-orientation that is receptive to feedback (Payne, Youngcourt, & Beaubien, 2007) and unintentional learning through the spontaneous absorption of material (Schmeck, 1999). Thus, prior research shows that students who are more thoughtful and analytical are more likely to perform well academically.

Some have also suggested that matching learning styles to teaching methods increases academic achievement (Sternberg & Zhang, 2001). This notion should be taken with caution, given a comprehensive review and critique by Pashler, McDaniel, Rohrer, and Bjork (2008) showing a lack of empirical support for the validity of tailoring teaching styles to students' learning styles. Recognizing that all humans have the potential to learn and have individual preferences for how they study, Pashler et al. emphasize investigating strategies that enhance learning and recall in general, as opposed to the matching of teaching techniques with specific learning styles. In the current study, we focus on the general value of specific learning styles in enhancing learning and their role in mediating personality-academic relationships rather than on whether matching learning styles and teaching methods enhances academic achievement.

2.6. Personality, learning styles and academic achievement

Despite considerable data supporting the importance of students' personality traits and learning styles, there is little knowledge about the combined effects of these two variables in explaining academic achievement. Some evidence suggests that personality and learning styles together predict performance in medical school (Ferguson, James, & Madeley, 2002). Further, openness has been found to be associated with learning styles that are positively associated with academic success (Farsides & Woodfield, 2003). However, Busato, Prins, Elshout, and Hamaker (2000) report mixed results regarding the association between personality, learning styles, and academic success. Specifically, they found that although conscientiousness and openness were significantly correlated with learning styles and academic success, learning styles were not significantly related to overall academic success. Thus, the paucity of current research as well as the inconsistency in findings calls for a closer examination of how individual differences in personality traits might be related to preferred strategies for learning and how these might influence academic achievement.

2.7. The current study

Prior research has established that both personality traits and learning styles are associated with academic achievement. However, not much is known about the joint influence of personality traits and learning styles on academic achievement. We also do

not know how learning styles might mediate the relationship between personality traits and academic performance. In the current research, we sought to fill this gap in the literature by directly examining relationships between personality, learning styles, and academic achievement, and by examining the extent to which relationships between personality and academic achievement might be mediated by specific learning styles. Specifically, we tested the following hypotheses:

(1) Regarding openness, individuals who score high on this trait display a strong intellectual curiosity and are eager to learn. Because deep processing may be facilitated by curiosity, we predicted that openness would be positively related with the reflective learning styles (synthesis-analysis and elaborative processing). Also, because the desire for deeper understanding is likely to facilitate academic performance, we predicted that openness would be positively related with GPA.

(2) Conscientious individuals are likely to be high achievers as they have a strong work ethic and are more likely to use deliberative, focused learning strategies. Hence, we predicted that conscientiousness would be positively associated with the agentic learning styles (methodical study and fact retention). Because individuals who are conscientious tend to be disciplined and achievement-oriented, we also predicted that conscientiousness would be positively related with GPA.

(3) Regarding agreeableness, due to the broadly beneficial effects of cooperative attitudes, we predicted that agreeableness would be positively related with all four learning styles. Agreeable individuals are usually cooperative, trusting, and helpful and may be more likely to meet deadlines. So we also predicted that this trait would be positively associated with GPA.

(4) Regarding neuroticism, individuals who experience anxiety, self-doubt, and negative emotionality are likely to be disengaged from the learning process and may not persist when facing difficulties. Hence, we predicted that neuroticism would be negatively related with all four strategies, as well as with GPA.

(5) As extraversion may be context-specific, we had no a priori predictions for how this dimension would be related with either learning styles or GPA.

(6) Because synthesis-analysis and elaborative processing are both reflective learning styles that facilitate deeper understanding, we predicted that both these learning styles would be positively associated with GPA.

(7) Because openness and reflective learning styles enable individuals to gain more knowledge, we expected both to be positively associated with GPA (as noted above). In addition, these variables may operate jointly, such that openness is most beneficial to learning when students adopt reflective learning styles. Thus, we explored whether the relationship between openness and GPA would be mediated by the two reflective learning styles, synthesis-analysis and elaborative processing.

3. Method

Participants were 308 undergraduate college students, including 147 males (47.7%) and 161 females (52.3%) who completed the Five Factor Inventory (NEO-FFI), the Inventory of Learning Processes (ILP), reported their current GPA, and provided demographic information. Students represented all undergraduate classes (56.2% freshmen, 17.9% sophomores, 9.4% juniors, and 15.9% seniors), had a variety of majors (liberal arts, business, education, science, engineering, applied sciences and arts, mass communication,

and agriculture), and varied somewhat in ethnicity (66.2% European American, 22.7% African American, 2.6% Latin American, 1.9% Asian American, and 1% Native American), with 95% of the students ranging between 18 and 24 years of age.

The NEO-FFI consists of 60 items designed to assess the Big Five personality traits. It is the most widely used and robust measure of personality traits with sound psychometric properties established by previous researchers (Costa & McCrae, 1992). In the present study, the Cronbach alpha values for each subscale's internal consistency were as follows: .84 (neuroticism), .74 (extraversion), .68 (openness), .74 (agreeableness), and .83 (conscientiousness).

The Inventory of Learning Processes (ILP, Schmeck, Ribich, & Ramanaiah, 1977) is a widely used 62-item measure that assesses two categories of learning styles: reflective and agentic. Reflective learning styles include synthesis-analysis (18 items) and elaborative processing (14 items), and agentic learning styles include methodical study (23 items) and fact retention (7 items). A number of studies have found good initial evidence for internal consistency and construct validity, as well as for structural validity based on factor-analytic results (Schmeck, Ribich, & Ramanaiah, 1977; Schmeck & Ribich, 1978). In the present study, alphas were .75 (synthesis-analysis), .67 (elaborative processing), .65 (fact retention), and .84 (methodical study). Because the alphas for two of the subscales were relatively low, following an item analysis, we removed 2 items from fact retention and 3 items from elaborative processing, producing acceptable alphas of .70 for each subscale. The correlation between the two reflective learning styles was .56, and between the two agentic learning styles was .24. Correlations that compared across the two categories of learning styles ranged from .19 to .42.

4. Results

4.1. Correlation analyses

Correlation analyses indicated a number of significant relationships (see Table 1). Specifically, consistent with our predictions, (a) openness was positively related with the two reflective learning styles (synthesis-analysis and elaborative processing), (b) neuroticism was negatively related with all the four learning styles, and (c) agreeableness and conscientiousness were positively related to all the four learning styles. Finally, extraversion was positively related with fact retention and elaborative processing. It is interesting that three personality traits (openness, agreeableness, and conscientiousness) and all the four learning styles were positively correlated with GPA.

4.2. Regression analyses

We first examined the extent to which the Big Five personality traits predicted each of the four learning styles (see Table 2). We found that neuroticism, openness, and conscientiousness explained 30% of the variance in synthesis-analysis, $F(5, 300) = 25.49, p < .001$; openness and conscientiousness explained 19% of the variance in elaborative processing, $F(5, 300) = 14.43, p < .001$; openness and conscientiousness explained 30% of the variance in methodical study, $F(5, 299) = 25.29, p < .001$; and conscientiousness explained 9% of the variance in fact retention, $F(5, 300) = 6.11, p < .001$.

Next, we examined which specific Big Five personality traits and learning styles explained significant variation in GPA (see Table 3). The Big Five traits explained 15% of the variance in GPA with neuroticism, openness, agreeableness and conscientiousness emerging as significant predictors, $F(5, 252) = 8.56, p < .001$. Learning styles explained 10% of the variance in GPA, $F(4, 254) = 6.77$,

Table 1
Correlations between the Big Five personality traits, learning styles and GPA.

Big Five personality traits	Learning styles subscales				
	Elaborative processing	Synthesis analysis	Methodical study	Fact retention	GPA
Neuroticism	−.17[**]	−.34[**]	−.13[**]	−.21[**]	−.00
Extraversion	.11[**]	.08	.01	.10	.07
Openness	.34[**]	.33[**]	.05	.03	.13[*]
Agreeableness	.18[**]	.22[**]	.15[**]	.21[**]	.22[**]
Conscientiousness	.22[**]	.30[**]	.53[**]	.27[**]	.29[**]
GPA	.18[*]	.23[**]	.24[**]	.15[**]	

Note: N ranges from 217 to 308.
[*] $p < .05$.
[**] $p < .01$.

Table 2
Multiple regression analyses with the Big Five traits regressed on each of the four learning styles.

Factor	Predictor	Beta	R^2	Adjusted R^2
Synthesis-analysis	Neuroticism	−.31[***]		
	Openness	.37[***]		
	Conscientiousness	.21[***]		
			.30	.29
Elaborative processing	Openness	.36[***]		
	Conscientiousness	.21[***]		
			.19	.18
Methodical study	Openness	.12[*]		
	Conscientiousness	.58[***]	.30	.29
Fact retention	Conscientiousness	.21[***]	.09	.08

[*] $p < .05$.
[***] $p < .001$.

Table 3
Two separate multiple regression analyses with the Big Five traits regressed on GPA and the four learning styles regressed on GPA.

Factor	Predictor	Beta	R^2	Adjusted R^2
GPA	Neuroticism	.19[**]		
	Extraversion	.04		
	Openness	.14[*]		
	Agreeableness	.15[*]		
	Conscientiousness	.33[***]		
			.15	.13
GPA	Elaborative processing	.02		
	Synthesis-analysis	.18[*]		
	Methodical study	.20[**]		
	Fact retention	.02		
			.10	.08

[*] $p < .05$.
[**] $p < .01$.
[***] $p < .001$.

Table 4
Hierarchical multiple regression analyses with the significant Big Five personality traits and four learning styles regressed on GPA.

Factor		Predictor	Beta	R^2	Adjusted R^2
GPA	Step1	Neuroticism	.25[**]		
		Openness	.05		
		Agreeableness	.19[**]		
		Conscientiousness	.29[**]		
				.14	
	Step 2	Synthesis-analysis	.15[*]		
		Methodical study	.09	.17	.15

[*] $p < .05$.
[**] $p < .01$.

$p < .001$, with synthesis-analysis and methodical study as the significant predictors.

To investigate whether learning styles explained significant variation in GPA over and above Big Five traits, we conducted a hierarchical regression analysis (see Table 4). In the first step, we entered four of the Big Five personality traits that previously emerged as significant predictors, and in the second step, we entered two of the four learning styles that previously emerged as significant predictors. Personality traits explained 14% of the variance in GPA (with neuroticism, agreeableness, and conscientiousness as significant predictors) and learning styles explained an additional 3% of the variance (with synthesis-analysis as the only significant predictor). Personality traits and learning styles together explained 17% of the variance in GPA, $F(6, 250) = 8.71$, $p < .001$.

4.3. Mediation analyses

To obtain a deeper understanding of the intricate relationship between personality traits and learning styles as predictors of academic performance, we investigated the extent to which learning styles mediated the relationship between personality and GPA using multiple regression analyses (Baron & Kenny, 1986). The results showed that synthesis-analysis and elaborative processing (both reflective learning styles) partially mediated the relationship between openness and GPA. In particular, when elaborative processing was included, the relationship between openness and GPA was significantly reduced from .13 to .08, Sobel's test = 2.23, $p < .05$ (see Fig. 1). Likewise, when synthesis-analysis was included, the relationship between openness and GPA was reduced from .13 to .06, Sobel's test = 2.93, $p < .01$ (see Fig. 1).

5. Discussion

Our results establish a number of interesting linkages between the Big Five personality traits, learning styles, and academic achievement, and also show that relationships between openness and GPA are partially mediated by reflective learning styles. Taken as a whole, these findings yield a number of insights with potential practical implications on the dynamic interplay between personality and learning styles, as well as on their joint influence on academic achievement.
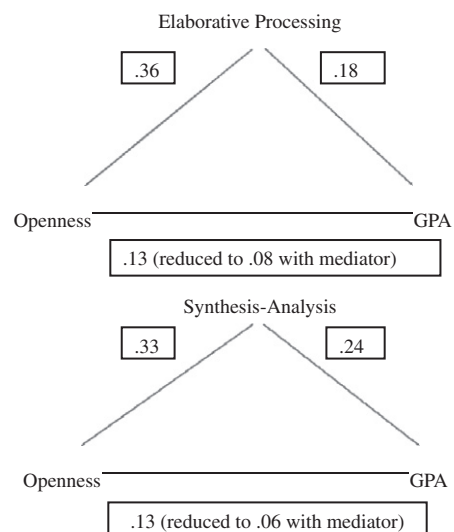
Fig. 1. Openness and GPA partially mediated by elaborative processing and synthesis-analysis.

First, our personality results have several significant implications for students and instructors. Perhaps most notably, our results establish that being conscientious is critical for learning and performance. Conscientiousness was positively and significantly associated with all four learning styles, and also showed the strongest association of any of our predictors with GPA. Thus, conscientiousness appears to facilitate a variety of effective learning strategies and may be an especially useful trait for attaining high levels of academic achievement. Students who are careless and do not study systematically are more likely to see their performance suffer. We also found that both agreeableness and openness were positively associated with GPA. This suggests that, besides being conscientious, students may also benefit from being cooperative and intellectually curious. Instructors who are sensitized to the importance of these personality traits as predictors of academic achievement could design course assignments and testing methods that foster conscientiousness (e.g., requiring drafts of assignments to be submitted in small parts), agreeableness (e.g., supporting and rewarding cooperative behaviors), and openness (e.g., capturing students' imaginations by linking concepts to current events).

Second, all four learning styles were correlated with GPA, consistent with the notion that these styles represent different approaches to information processing that all have some value for learning (Schmeck et al., 1977). In addition, results from our regression analyses support the reasoning that reflective styles are conducive to deeper or more thoughtful learning (Schmeck, 1999). Namely, synthesis-analysis was the only learning style explaining significant variation in GPA over and above the Big Five, and we found that both synthesis-analysis and elaborative processing partially mediated the positive relationship between openness and GPA. Thus, instructors who employ techniques that nurture synthesis-analysis and elaborative processing may be more likely to generate greater student interest and achievement. For example, an instructor who explains a concept or theory by giving personal life examples, refers to relevant current events, illustrates the material using hierarchical concepts, or organizes information around meaningful themes may help students process information more thoughtfully.

Third, regarding the relationship between personality traits and learning styles, conscientiousness and openness predicted each of the four learning styles. This suggests that students who are organized, disciplined, determined, and intellectually curious are more likely to use all four learning styles in maximizing their learning. Such students are likely to be very thorough, relate what they are learning to previous knowledge and to their own lives, and to study in a systematic way, thus, excelling on exams. On the other hand, the negative relationships between neuroticism and all four learning styles suggest that students who are given to worry and anxiety are likely to disengage from the learning process and fail to organize and categorize what they are learning into meaningful units.

Finally, although openness emerged as central to deep processing of information, a key goal in many university courses, we discovered that reflective learning styles (elaborative processing and synthesis-analysis) are critical to the relationship between openness and GPA. Namely, the relationship between openness to experience and academic achievement was partially mediated by both elaborative processing and synthesis-analysis. This suggests that the tendency for openness to enhance GPA is due, at least in part, to intellectually curious students actively processing information by organizing what they learn into meaningful categories and making insightful connections to personal life situations. Thus, it may be advantageous for students who are intellectually curious and open to novel ideas and theories to become more aware of their personal preferences for specific learning styles and gradually develop a more reflective style. Perhaps they could consciously practice making insightful connections across their courses, organizing information into meaningful units, and finding personal relevance in what they learn. This would be particularly relevant as they progress through college and as they move from undergraduate to graduate or professional degree programs.

Although our research sheds some valuable insights into the joint influence of personality traits and learning styles on academic achievement, we must acknowledge that it has some limitations. Most notably, future research could seek participants' permission to obtain grades from school records instead of relying on students' self-reported GPA (Grzegorek, Slaney, Franze, & Rice, 2004). Although prior research has found GPA obtained from school records to be positively and strongly correlated with self-reported GPA (e.g., $r = .89$, Noftle & Robins, 2007), it might nevertheless contain some error due to inflated estimates or mistaken recall. Future researchers could also seek to go beyond self-report measures and include behavioral indicators of academic performance such as attendance, persistence, and time taken to complete a degree.

To conclude, our results make an important contribution to our understanding of academic achievement both by identifying a number of linkages between personality, learning styles, and academic achievement, and by helping us understand how learning styles mediate the relationship between personality traits and academic achievement. Future research could further our comprehension of the complex nature of academic achievement by examining other individual difference factors (such as self-efficacy or implicit theories of intelligence) as well as environmental factors such as socioeconomic status or type of college (public or private, small or large) as predictors of academic achievement.

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