Journal of the International Neuropsychological Society (2024), 1–8
doi:10.1017/S135561772400047X

Research Article

Determining associations between Big Five personality traits and executive function in an undergraduate student sample

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Abstract

Objective The present study sought to determine the associations between executive functioning and Big Five personality traits in an undergraduate sample. **Method:** Participants included 200 undergraduates (73% women), with a mean age of approximately 21 years. Participants completed the Big Five Inventory-44 and a psychological assessment battery, which included the Trail Making Test and the Semantic Fluency Test. **Results:** Results from multiple regression analyses suggested agreeableness was negatively associated with Semantic Fluency – Animals ($\beta = -0.310$, $p < 0.001$). Moreover, conscientiousness was positively associated with Trail Making Test B-A ($\beta = 0.197$, $p = 0.016$), but negatively associated with Trail Making Test A ($\beta = -0.193$, $p = 0.017$). **Conclusions:** Overall results identified that executive function association with personality varies by construct. Given conscientiousness' differential associations within the executive function task performances, future research should examine the conscientious threshold that would result in psychological symptomatology associated with extreme lows and highs in conscientiousness.

Keywords: Big Five; executive function; undergraduates; conscientiousness; cognitive flexibility; neuroticism

(Received 16 January 2024; final revision 10 July 2024; accepted 11 July 2024)

Introduction

Individuals entering college often experience significant novel environmental changes (Kidwell, 2005). Executive functions may be heavily relied upon during this period, due to colleges and/or universities being more intellectually demanding (McKee, 2017) and requiring goal-oriented behavior (Ahrens et al., 2019; Turkstra & Byom, 2010). Executive function consists of various cognitive processes, including cognitive flexibility, visuospatial abilities, and semantic fluency (Bigelow & Agrawal, 2015; Carvalho & Ready, 2010; gray, 2001); each critical for academic success (Goldstein & Naglieri, 2014). College students often experience stressors in pursuit of academic success, and being able to efficiently navigate through these stressors is crucial (Karaman et al., 2019; Hubbard et al., 2018). Thus, individual differences in a person's personality traits may influence how the student modulates their executive functions (Murdock et al., 2013).

The most consistently reported Big Five personality trait that is associated with executive function performance is neuroticism, with much of the scientific literature presenting a negative relationship (Crespo-Sanmiguel et al., 2024; Saylik et al., 2018; Waggel et al., 2015). In contrast, higher levels in some other personality traits (e.g., conscientiousness, agreeableness, and openness) are reported to be associated with better executive functioning task performance (Crow, 2019; Mercuri & Holtzer, 2021). Specifically, openness to experience is associated with better memory (Luchetti et al., 2016), verbal fluency (Chapman et al., 2017), and cognitive flexibility (Murdock et al., 2013) task performance. Similar positive findings were reported for conscientiousness when determining its association with visuospatial abilities in nonclinical samples (Carbone et al., 2019; Sutin et al., 2019). Other researchers have argued conscientiousness' positive association with executive function may be attributable to cognitive flexibility (Fleming et al., 2016). In addition to conscientiousness, agreeableness seems to obtain a conceptual and behavioral overlap in executive functioning (Jensen-Campbell et al., 2002; Kochanska et al., 2007; Williams et al., 2010). Previous research also suggests that agreeableness has a positive association with working memory, a vital component of executive function (Waris et al., 2018).

The personality trait extraversion reported mixed findings with executive function tenets. Specifically, research suggests extraversion has little to no association with working memory or cognitive flexibility (Crow, 2019; Krieger et al., 2020). Researchers posit this relationship may not exist without extraversion having a modulating positive mood construct to aid in facilitating the relationship (Stafford et al., 2010). In contrast to the null or negative findings, experimental researchers suggest that extraversion may differentiate among executive functioning tasks as a

Corresponding author: Emma Quarles; Email: Equa9524@students.vsu.edu
Cite this article: Quarles E., West S.J., & Keen L. Determining associations between Big Five personality traits and executive function in an undergraduate student sample. *Journal of the International Neuropsychological Society*, 1–8, https://doi.org/10.1017/S135561772400047X

function of complexity (Campbell et al., 2011). Extraversion's positive association with cognitive flexibility task performance has also been reported (Herrmann & Wacker, 2021). These findings are supported by cross-sectional analyses suggesting extraversion has a positive relationship with working memory (Dubey et al., 2014). Yet, various outcomes on this relationship between extraversion and executive function performance show inconsistency in results (Campbell et al., 2011).

Overall, many of the studies that examine the relationship between personality traits and executive function task performance are conducted in older adults (Mercuri & Holtzer, 2021) and in clinical samples (Snyder, 2013). Literature has also consistently found neuroticism as a risk factor for severe internalizing symptoms (Speed et al., 2019; Vinograd et al., 2020). Internalizing symptom severity has also been reported to be deleterious to executive function task performance, including semantic fluency (Krogh et al., 2014), cognitive flexibility (Ajilchi & Nejati, 2017), and visuospatial processing (Blanken et al., 2017). Previous research also posits that the personality trait and executive function relationship may be a function of younger age (Graham & Lachman, 2014), with various relationships persisting in undergraduates, but not older adults. Ultimately, the relationship between personality traits and executive function task performance is still controversial, as previous research also reports weak to no relationship between executive function components and extraversion (Segel-Karpas & Lachman, 2018), conscientiousness (Waris et al., 2018), agreeableness (Vaughan & Edwards, 2020), and openness (Schretlen et al., 2010). Yet neuroticism has been consistently negatively associated with executive function task performance (Saylik et al., 2018).

Personality traits' complex structure requires the activation and potential interaction between neurobehavioral mechanisms, including executive functions (Nikolasevic et al., 2024). Previous research posits personality traits are relied upon executive function (Forbes et al., 2014). Personality traits are comprised of constructs (e.g., goal-oriented behavior, impulsivity) that have direct executive functioning parallels. Much of the scientific literature reports findings on selected personality traits' associations with executive functions (Campbell et al., 2011; Fleming et al., 2016; Ihle et al., 2019). However, very few studies have examined the associations among all of the Big Five personality traits and objective executive function task performance. The purpose of the current study is to determine associations between personality traits and executive function task performance among undergraduate college students. We hypothesize positive associations between some personality traits (i.e., conscientiousness, openness, extraversion, and agreeableness) and cognitive flexibility, semantic fluency, and visuospatial task performance. Additionally, we expected neuroticism to have a negative association with each executive function task performance.

Method

Participants

Participants in the current study consisted of undergraduate students from a historically Black university in central Virginia from the parent study entitled, "*The Neuropsych Study*" (Keen et al., 2022). Undergraduate students were recruited from the Psychology, Mathematics, Engineering, and Biology departments. The participants' ages ranged between 18 and 47 years, with a mean age of 21.11 (standard deviation = 4.51) years. There were a total of 200 participants, including 146 females and 54 males. In order to participate in the current study, participants had to be undergraduate students and self-report a history of no traumatic brain injury during their lifetime. This study received annual approval from Virginia State University's Institutional Review Board. The presented research was conducted in compliance with the Helsinki Declaration (Rickham, 1964).

Procedure

The current study's procedure consisted of a one-time administration visit, which lasted approximately 45 minutes. Upon participant's entry into the laboratory, a trained research assistant obtained informed consent. After informed consent was received, participants completed a series of questionnaires including a demographic questionnaire. We then administered a series of psychological assessments, which included the Trail Making Test (TMTA, TMTB, and TMTB-A) and Semantic Fluency (Semantic Fluency-Animals, Semantic Fluency-Vegetables, and Semantic Fluency-Fruits). Upon completion, participants' names were sent to professors to receive extra credit in an undergraduate class.

Measures

Big Five inventory

The personality traits were measured using the Big Five Inventory (BFI; John et al., 1991). The BFI was a 44-item self-report measure that assessed each big five trait from the Five-Factor Model of Personality (Costa & McCrae, 1999): openness to experience (10 items), conscientiousness (9 items), extraversion (8 items), agreeableness (9 items), and neuroticism (8 items). Participants responded to each of the items on a scale of 1 (strongly disagree) to 5 (strongly agree). Each personality trait scale was averaged. The higher scores represent stronger personality traits.

The Trail Making Test

The Trail Making Test (TMT-A and TMT-B) is a timed assessment measuring visuospatial tracking, set-shifting, and cognitive flexibility, among other executive function components. The TMT administration took approximately 5–10 minutes, with the objective requiring participants to connect numbers and/or letters in sequential order without lifting their pencils off the paper (Reitan, 1956). TMT-A consisted of only numbers and the TMT-B consisted of numbers and letters. Additionally, TMT-A subtracted from TMT-B yielded the TMTB-A score, which measures cognitive flexibility (Corrigan & Hinkeldey, 1987). Scoring for the TMT was based on time lapsed, with higher scores indicating poorer performance.

Semantic fluency

Semantic Fluency is a neuropsychological assessment that measures memory recall, vocabulary, working memory, and fluid intelligence (Benton & Hamsher, 1976). This measure takes approximately five (5) minutes to administer. Each item requires the participant to name words or objects that fit the given category. The measure categories were animals, vegetables, and fruits. All animals could be scored as correct for the animal category/type. Names such as "dog" and "cat" were accepted as canines and felines. Other generic domesticated terms like "cow" were also accepted. Each point indicated one accepted response. For vegetables and fruits, one correct response (being any fruit or vegetable depending on the task) was given one point. Total points were summed at the end of the 60 seconds for the final score.

https://doi.org/10.1017/S135561772400047X Published online by Cambridge University Press

Covariates

Demographic form

The demographic form was developed to collect general information about the participants. The form inquired about the participant's age, biological sex, years of education, and employment status. Sex was dummy-coded as "0" for females and "1" for males. Employment status was dummy-coded as "0" for no current job, "1" for part-time job, "2" for full-time employment, and "3" for retired. Years of education were counted as the number of years the participant has been in school, beginning with the first grade.

Beck Depression Inventory-II

The Beck Depression Inventory (BDI-II) was used to determine depressive symptom severity. The BDI-II is a self-report scale used to measure internalizing symptoms such as appetite changes, sleep changes, sad mood, hopelessness, helplessness, suicidal ideations, and attention difficulties in adults. The BDI-II consists of 21 statements and responses ranging from 0 to 3, based on which response is most relatable to the individual. Statements such as, "I do not expect things to work out for me.", "I dislike myself.", and "I am so sad or unhappy that I can't stand it.". Scores of 0 to 13 indicate minimal depressive symptoms, 14 to 19 indicate mild, 20 to 28 are moderate depressive symptoms, and scores above 29 indicate severe depressive symptoms (Beck et al., 1996). This measure has been used in Black/African American samples (Keen et al., 2015; Keen et al., 2020) and has been reported to have an association with both personality traits (Buhan et al., 2017; Perkovic & Pechenkov, 2023) and executive function (Klojčnik et al., 2017). This measure was administered due to the parent study entitled, *"The Neuropsych Study,"* which sought to determine the association of depressive symptoms and executive function.

Data analysis

Data were analyzed using Statistical Package for Social Sciences, version 27 (IBM, 2020). Continuous variables were presented as mean (standard deviation). Frequencies and percentages were utilized for categorical variables. Pearson r correlations were employed to determine the association between demographic covariates, depressive symptoms, personality trait scores, and executive functioning measures. The demographic variables age, sex, years of education, employment, and depressive symptoms were treated as covariates in the regression analyses to address the study hypotheses. The primary predictors were extraversion, agreeableness, conscientiousness, neuroticism, and openness scales. Confidence intervals were reported for each predictor as effect sizes (Lee, 2016). A sensitivity analysis conducted in G*Power version 3.1.9.7 (Erdfelder et al., 1996) for $N = 200$ and five predictors revealed our sample was able to reliably estimate models with $R^2 = 0.01$ or greater at 80% power. Similarly, our sample was powered to detect zero-order correlations of $r = 0.19$ or above at 80% power.

Results

Descriptive

This current study consisted of 200 undergraduate students at a historically Black university. One hundred forty-six (73%) of those participants were female. Participants' mean age was 21.11 (SD = 4.52). The majority of the sample was either unemployed (47%) or had a part-time job (41%). These results and others can be found in Table 1.

Table 1. Descriptive statistics

		M/F (SD/%)
Age		21.11 (4.52)
Sex	**Male**	54 (27%)
	Female	146 (73%)
Total years of education		14.50 (1.74)
Employment	**Unemployed**	93 (46.50%)
	Part time	81 (40.50%)
	Full time	26 (13%)
BDI Total Score		10.19 (7.33)
Extraversion		3.48 (0.78)
Agreeableness		4.01 (0.54)
Conscientiousness		3.66 (0.61)
Neuroticism		3.03 (0.79)
Openness		3.62 (0.52)
TMTA		24.66 (0.52)
TMTB		58.33 (27.97)
TMTB-A		33.67 (26.25)
Semantic Fluency- Animals		18.99 (4.73)
Semantic Fluency- Vegetables		11.41 (3.65)
Semantic Fluency- Fruits		12.53 (3.65)

Note: BDI Total Score = Beck Depression Inventory Total Score; TMTA = Trail Making Test Trial A; TMTB = Trail Making Test Trial B; TMTB-A = Trail Making Test Trial A Subtracted from Trial B.

Correlations

Zero-order correlations were conducted between covariates, personality subscales, and executive functioning measures. Extraversion was negatively correlated with depressive symptoms. Agreeableness was negatively correlated with sex, depressive symptoms, and semantic fluency animals. Conscientiousness was positively correlated with age but negatively correlated with depressive symptoms and TMTA. Neuroticism was negatively correlated with sex but positively correlated with depressive symptoms. Openness was not statistically significant. These results and others can be found in Table 2.

Regression

Multiple regression analyses were employed to determine the associations between personality traits and executive function task performance in the presence of age, sex, education, employment, and depressive symptom covariates. Regression findings suggest conscientiousness was unexpectedly negatively associated with TMTA ($\beta = -0.193$, $p = 0.017$) but positively associated with TMTB-A ($\beta = 0.197$, $p = 0.016$). Openness was positively associated with TMTA ($\beta = 0.166$, $p = 0.029$), which was expected from our hypothesis. Agreeableness was also negatively associated with Semantic Fluency-Animals ($\beta = -0.310$, $p < 0.001$) and Semantic Fluency-Fruits ($\beta = -0.215$, $p = 0.007$), this was unexpected from our hypothesis. Neuroticism was negatively associated with Semantic Fluency-Vegetables ($\beta = -0.268$, $p = 0.005$), which supported our hypothesis. These results and others can be found in Tables 3 and 4. Scatter plots for each regression can be seen in Supplemental Materials labeled Figure 1.

Discussion

The current study sought to determine the association between personality traits and executive function task performance in undergraduate students. Agreeableness was negatively associated with two Semantic Fluency tasks, which was contrary to the study hypothesis. Openness was positively associated with TMTA, which was expected. Neuroticism was negatively associated with one

https://doi.org/10.1017/S135561772400047X Published online by Cambridge University Press

Table 2. Correlations among neuropsychological scores, personality traits, and demographic variables

	Age	Sex	Edu	Emp	BDI	TMTA	TMTB	TMTB-A	SF-A	SF-V	SF-F	Extra	Agree	Consci	Neuro
Age															
Sex	−.045														
Edu	.447**	−.105													
Emp	−.353**	.031	−.347**												
BDI	−.099	−.219**	.001	.011											
TMTA	−.004	−.002	.021	.042	−.036										
TMTB	−.015	.027	.014	−.019	.040	.346**									
TMTB-A	−.015	.029	.007	−.036	.057	−.011	.935**								
SF-A	.000	.063	−.013	−.019	−.002	−.128	−.095	−.053							
SF-V	.120	−.156*	.051	−.087	.030	−.091	−.082	−.053	.233**						
SF-F	.080	−.140*	.062	−.097	.101	−.053	−.068	−.052	.412**	.533**					
Extra	.063	.025	.067	−.101	−.139*	−.056	−.023	−.003	.102	−.003	.064				
Agree	.052	−.142*	−.010	.031	−.141*	−.076	−.057	−.032	−.254**	−.061	−.133	.170*			
Consci	.208**	.010	.110	−.132	−.308*	−.150*	.072	.133	−.002	.027	.045	.145*	.315**		
Neuro	−.123	−.422**	−.019	.032	.528**	−.027	−.008	.002	−.013	−.081	.065	−.233**	−.215**	−.276**	
Open	.071	.024	.063	−.122	.045	.090	.039	.007	−.003	−.043	.081	.242**	.198**	.160*	−.005

Zero-order correlations between demographic, depressive symptoms, big five personality traits, and executive function.
Note: **= $p < .01$; *= $p < .05$; Edu = Years of Education; Emp = Employment; BDI = Beck Depression Inventory; TMTA = Trail Making Test A; TMTB = Trail Making Test B; TMTB-A =Trail Making Test B-A; SF-A = Semantic Fluency Animals; SF-V = Semantic Fluency Vegetables; SF-F = Semantic Fluency Fruit; Extra = Extraversion; Agree= Agreeableness; Consci = Conscientiousness; Neuro = Neuroticism; Open = Openness.

Table 3. Trail making test regressed on personality traits and demographic covariates

		R^2	β (SE)	*p*-value	CI (95%)
TMTA		0.064			
	Age		0.011 (0.182)	0.891	(−0.333, 0.383)
	Sex		−0.071 (1.832)	0.385	(−5.208, 2.019)
	Education		0.041 (.465)	0.612	(−0.681, 1.152)
	Employment		0.055 (1.117)	0.480	(−1.413, 2.994)
	BDI		−0.089 (0.115)	0.299	(−0.348, 0.108)
	Extraversion		−0.086 (0.956)	0.257	(−2.971, 0.800)
	Agreeableness		−0.079 (1.457)	0.319	(−4.330, 1.420)
	Conscientiousness		**−0.193 (1.309)**	**0.017**	**(−5.749, −0.585)**
	Neuroticism		−0.100 (1.191)	0.295	(−3.600, 1.099)
	Openness		**0.166 (1.444)**	**0.029**	**(0.322, 6.017)**
TMTB		0.021			
	Age		−0.043 (0.522)	0.613	(−1.294, 0.765)
	Sex		0.011 (5.264)	0.895	(−9.689, 11.079)
	Education		0.016 (1.335)	0.847	(−2.375, 2.891)
	Employment		−0.008 (3.209)	0.920	(−6.653, 6.009)
	BDI		0.079 (0.332)	0.367	(−0.354, 0.954)
	Extraversion		−0.033 (2.746)	0.666	(−6.603, 4.230)
	Agreeableness		−0.091 (4.188)	0.263	(−12.962, 3.559)
	Conscientiousness		0.116 (3.761)	0.157	(−2.072, 12.767)
	Neuroticism		−0.045 (3.423)	0.646	(−8.325, 5.177)
	Openness		0.043 (4.148)	0.576	(−5.859, 10.505)
TMTB-A		0.038			
	Age		−0.050 (0.485)	0.552	(−1.247, 0.668)
	Sex		0.039 (4.897)	0.641	(−7.370, 11.949)
	Education		0.001 (1.242)	0.986	(−2.427, 2.472)
	Employment		−0.030 (2.985)	0.710	(−7.002, 4.777)
	BDI		0.117 (0.309)	0.175	(−0.188, 1.029)
	Extraversion		−0.003 (2.554)	0.969	(−5.139, 4.938)
	Agreeableness		−0.067 (3.896)	0.406	(−10.930, 4.438)
	Conscientiousness		**0.197 (3.499)**	**0.016**	**(1.613, 15.416)**
	Neuroticism		−0.010 (3.184)	0.919	(−6.604, 5.956)
	Openness		−0.017 (3.858)	0.827	(−8.457, 6.764)

Multivariate regression between demographic, depressive symptoms, big five personality traits, and executive function.
Note: TMTA = Trail Making Test Trial A; TMTB = Trail Making Test Trial B; TMTB-A = Trail Making Test Trial A subtracted from B; BDI = Beck Depressive Inventory; ** = $p < 0.01$; * = $p < 0.05$.

Semantic Fluency task, which was consistent with previous literature (Sutin et al., 2019). Additionally, conscientiousness was negatively associated with TMTA but was positively associated with TMTB-A. This unexpected finding between conscientiousness and measures that focus on different types of executive function constructs (e.g., cognitive flexibility *vs.* visuospatial) may speak to both the healthy and deleterious influences of conscientiousness (Douglas et al., 2023).

Previous research suggests cortical-related activity is associated with personality traits (Altinok et al., 2021). Specifically, agreeableness is positively associated with the Default Mode Network (Sampaio et al., 2014). Reportedly the Default Mode Network can become inactive when the individual is asked to perform cognitively demanding tasks (Crittenden et al., 2015), which may account for agreeableness' negative association with semantic fluency in the current study. Further, Neuroticism is negatively associated with the left superior temporal gyrus activity (Lin et al., 2023), an area associated with auditory processing and language (Bigler et al., 2007). These functions are also required in the semantic fluency tasks (Gaillard et al., 2003). Openness has been positively associated with the attentional networks, these same functions are required for the TMTA (Wang et al., 2022), and in line with the positive association between visuospatial task performance and openness in the current study. Consistent with our findings, the anterior cingulate activity is negatively associated with visuospatial memory is also negatively associated with conscientiousness (Teixeira et al., 2006). The positive association between conscientiousness and more complex executive function tasks (cognitive flexibility) also aligns with previous activity-related findings. Specifically, conscientiousness is positively associated with activity in the lateral prefrontal cortex; an area involved in planning and cognitive flexibility (Tanji & Hoshi, 2008). In turn could further elucidate why conscientiousness was positively correlated with TMTB-A, as this measure assesses cognitive flexibility (Wang et al., 2022). This empirical literature suggests neuroanatomical overlap between personality traits and executive function (Forbes et al., 2014), providing neurobehavioral explanations for associations reported in the current study.

Few studies have reported a negative association between conscientiousness and executive function task performance (Waris et al., 2018). Waris et al (2018) identified this relationship with working memory, a key executive function component. In line with the limited findings in the literature, the current study also reports a negative association with consciousness between a task that includes attention, visual scanning, and visual perception. Previous research posits high levels of conscientiousness may also include obsessive-compulsive symptomatology and have adverse effects on

https://doi.org/10.1017/S135561772400047X Published online by Cambridge University Press

Table 4. Semantic fluency task regressed on personality traits and demographic covariates

		R^2	β (SE)	*p*-value	CI (95%)
SF-Animals		0.093			
	Age		0.006 (0.085)	0.939	(−0.161, 0.174)
	Sex		−0.002 (0.856)	0.984	(−1.706, 1.671)
	Education		−0.035 (0.217)	0.664	(−0.523, 0.334)
	Employment		0.007 (0.522)	0.931	(−0.984, 1.075)
	BDI		0.014 (0.054)	0.868	(−0.097, 0.115)
	Extraversion		0.137 (0.447)	0.067	(−0.059, 1.702)
	Agreeableness		**−0.310 (0.681)**	**<0.001**	**(−4.051, −1.365)**
	Conscientiousness		0.071 (0.612)	0.364	(−0.650, 1.763)
	Neuroticism		−0.036 (0.557)	0.697	(−1.315, 0.881)
	Openness		0.015 (0.674)	0.835	(−1.190, 1.471)
SF- Vegetables		0.090			
	Age		0.093 (0.066)	0.253	(−0.054, 0.205)
	Sex		**−0.263 (0.662)**	**0.001**	**(−3.462, −0.852)**
	Education		−0.041 (−0.168)	0.609	(−0.417, 0.245)
	Employment		−0.051 (0.403)	0.511	(−1.061, 0.530)
	BDI		0.106 (0.042)	0.206	(−0.029, 0.135)
	Extraversion		−0.026 (0.345)	0.730	(−0.800, 0.561)
	Agreeableness		−0.141 (0.526)	0.072	(−1.991, 0.085)
	Conscientiousness		0.019 (0.473)	0.813	(−0.820, 1.044)
	Neuroticism		**−0.268 (0.430)**	**0.005**	**(−2.077, −0.380)**
	Openness		−0.022 (0.521)	0.765	(−1.184, 0.872)
SF- Fruits		0.082			
	Age		0.048 (0.066)	0.560	(−0.092, 0.169)
	Sex		**−0.177 (0.666)**	**0.030**	**(−2.766, −0.140)**
	Education		−0.016 (0.169)	0.843	(−0.366, 0.300)
	Employment		−0.044 (0.406)	0.573	(−1.030, 0.572)
	BDI		0.104 (0.042)	0.217	(−0.031, 0.135)
	Extraversion		0.065 (0.347)	0.388	(−.384, 0.986)
	Agreeableness		**−0.215 (0.530)**	**0.007**	**(−2.494, −0.404)**
	Conscientiousness		0.093 (0.476)	0.243	(−0.381, 1.495)
	Neuroticism		−0.063 (0.433)	0.504	(−1.144, 0.564)
	Openness		0.084 (0.525)	0.262	(−0.444, 1.625)

Multivariate regression between demographic, depressive symptoms, big five personality traits, and executive function.
Note: SF = Semantic Fluency; BDI = Beck Depressive Inventory; ** = $p < 0.01$; * = $p < 0.05$.

an individual's psychological health (Samuel & Widiger, 2011; Carter et al., 2016).

Previous literature suggests that age may also be positively associated with conscientiousness levels (Soubelet, 2011). Individuals with better executive function task performance reported higher conscientiousness levels in an older adult sample (Baker & Bischel, 2006). Yet, in a study using adolescents, conscientiousness was negatively associated with short-term memory (Pearman, 2009). Specifically, the less complex task (visuospatial) held a negative relationship while the more complex executive function (cognitive flexibility) was positively associated with conscientiousness. These findings paired with the positive association between age and conscientiousness may reflect the usage of developmental heuristics in decision-making and other complex executive functions (Strough et al., 2011). Future research should look to isolate executive function subtypes to help identify which may serve as behavioral or health-related mechanisms. There are positive and negative health effects across the executive function performance spectrum, and this relationship may vary or be heavily influenced by conscientiousness (Hall & Fong, 2013).

Previous research suggests that openness is positively associated with executive function task performance (Schretlen et al., 2010). The current findings support this literature, openness was positively associated with visuospatial skills (TMTA). Literature also suggests that openness allows the individual to be open to more stimulating experiences that provide learning opportunities which results in improving cognitive ability levels (Chamorro-Premuzic & Furnham, 2004; Ihle et al., 2019). This positive relationship was not statistically significant until demographic, and other personality traits were statistically accounted for in the same model, leaving the potential for a modulating mechanism within covariates. Overall, higher levels of openness invoke more opportunities to further improve executive function skills, resulting in higher executive function performance.

Much literature suggests agreeableness is positively associated with semantic fluency (Sutin et al., 2019), visuospatial function (Sutin et al, 2019), and cognitive flexibility (Lange & Dewitte, 2019). However, the negative association between agreeableness and executive function task performance is also supported by previous research (Byrne et al., 2015). Byrne and colleagues suggest this negative relationship can be due to social pressure and possible test anxiety. Further, individuals who are more agreeable may have problems making decisions or fear others' judgment. Problems with agreeableness may present themselves as internalizing symptoms (Flory et al., 2002). These symptoms are typically behaviors or feelings that are negatively slanted toward the individual, by the individual.

In the present study, neuroticism was positively correlated with depressive symptoms, which supports previous research; on internalizing symptomatology, specifically severe depressive and anxious symptoms (Muris et al., 2005; Yoon et al., 2013). Depression has been known to negatively affect aspects of executive function (Friedman et al., 2018). Individuals with higher neuroticism scores become more at risk for depressive symptoms, and this association may also influence executive function. This notion is further supported in our findings of neuroticism's

https://doi.org/10.1017/S135561772400047X Published online by Cambridge University Press

negative association with Semantic Fluency. However, neuroticism was not associated with all semantic fluency tasks, which could speak to the wider variance with the specific topic of vegetables compared to the other subtests. Ultimately, neurotic and internalizing symptoms may disrupt organic and behavioral processes that facilitate efficient executive function activity (Chapman et al., 2012).

There are limitations that should be noted within the study. First, the participant pool consisted of only undergraduate students and cannot be generalized to other non-collegiate individuals within a similar age range. This study recruited participants from only one college within the university, excluding others on the university's campus. Given the cross-sectional nature of the study, we are unable to determine causality and may be underpowered to detect the expected effects. A longitudinal study design would allow for causal-based modeling for known covariates (i.e., depressive symptoms). This dataset did not contain objective measures to assess and then exclude learning disabilities, psychiatric history, ADHD, etc. This cross-sectional study did not allow us to use depressive symptoms as a mediator or moderator for our analyses.

In conclusion, our current study identified known (i.e., neuroticism) and rarely reported (negative associations with conscientiousness) associations between personality traits and executive function in a sample of undergraduate students. College students utilize executive function latent self-regulation in their daily lives (Cohen, 2012). As undergraduate students engage with their social environments, personality traits may modulate their perception and responsiveness to social stimuli (Robinson, 2007). Employing interventions that utilize personality trait targets (e.g., conscientiousness and neuroticism) may be a unique way to tailor cognitive training and performance (Studer-Luethi et al., 2012).

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/S135561772400047X.

Acknowledgements. The first and third author were supported by a Research Enhancement Award (1R15 DA052886-01A1 and 3R15DA052886-01A1S1) from the National Institute on Drug Abuse. The funding sources had no role in the design, conduct, or analysis of the study, or in the decision to submit the manuscript for publication. Data was not preregistered in an independent institutional registry. The contents herein are solely the responsibility of the authors and do not necessarily represent the official views of the National Institute on Drug Abuse or the National Institutes of Health.

Author contribution. The first author led the data collection, manuscript conceptualization, formal analysis, and overall writing of the manuscript. The second author supported efforts relating to manuscript conceptualization, manuscript review, and editing.

Competing interests. The authors declare that they have no known competing financial interests or personal relationships that could have influenced the results reported in this manuscript.

References

Ahrens, B., Lee, M., Zweibruck, C., Tumanan, J., Larkin, M. S., & Beck, A. (2019). *The role of executive function skills for college-age students*. Academia.

Ajilchi, B., & Nejati, V. (2017). Executive functions in students with depression, anxiety, and stress symptoms. *Basic and Clinical Neuroscience*, *8*(3), 223–232.

Altinok, D. C. A., Rajkumar, R., Nießen, D., Sbaihat, H., Kersey, M., Shah, N. J., Veselinović, T., & Neuner, I. (2021). Common neurobiological correlates of resilience and personality traits within the triple resting-state brain networks assessed by 7-Tesla ultra-high field MRI. *Scientific Reports*, *11*(1), 11564.

Baker, T., & Bichsel, J. (2006). Personality predictors of intelligence: Differences between young and cognitively healthy older adults. *Personality and Individual Differences*, *41*, 861-871. https://doi.org/10.1016/j.paid.2006.02.017

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Manual for the Beck depression inventory-II*. Psychological Corporation.

Benton, A. H., & Hamsher, K. D. K. (1976). *Multilingual aphasia examination*. University of Iowa.

Bigelow, R. T., & Agrawal, Y. (2015). Vestibular involvement in cognition: Visuospatial ability, attention, executive function, and memory. *Journal of Vestibular Research*, *25*(2), 73–89.

Bigler, E. D., Mortensen, S., Neeley, E. S., Ozonoff, S., Krasny, L., Johnson, M., Lu, J., Provencal, S. L., McMahon, W., & Lainhart, J. E. (2007). Superior temporal gyrus, language function, and autism. *Developmental Neuropsychology.*, *31*(2), 217–238.

Blanken, L. M., White, T., Mous, S. E., Basten, M., Muetzel, R. L., Jaddoe, V. W., & Tiemeier, H. (2017). Cognitive functioning in children with internalising, externalising and dysregulation problems: A population-based study. *European Child & Adolescent Psychiatry*, *26*, 445–456.

Buhan, H. D., Rehman, S., & Keat, O. B. (2017). The relationship between beck's depression inventory (BDI-II) and big five personality. *Journal of Management and Science*, *15*(1), 108–119.

Byrne, K. A., Silasi-Mansat, C. D., & Worthy, D. A. (2015). Who chokes under pressure? The Big Five personality traits and decision-making under pressure. *Personality and Individual Differences*, *74*, 22–28.

Campbell, A. M., Davalos, D. B., McCabe, D. P., & Troup, L. J. (2011). Executive functions and extraversion. *Personality and Individual Differences*, *51*(6), 720–725.

Carbone, E., Meneghetti, C., & Borella, E. (2019). The influence of personality traits and facets on visuo-spatial task performance and self-assessed visuo-spatial inclinations in young and older adults. *Plos One*, *14*(8), e0220525.

Carter, N. T., Guan, L., Maples, J. L., Williamson, R. L., & Miller, J. D. (2016). The downsides of extreme conscientiousness for psychological well-being: The role of obsessive compulsive tendencies. *Journal of Personality*, *84*(4), 510–522.

Carvalho, J. O., & Ready, R. E. (2010). Emotion and executive functioning: The effect of normal mood states on fluency tasks. *Journal of Clinical and Experimental Neuropsychology*, *32*(3), 225–230.

Chamorro-Premuzic, T., & Furnham, A. (2004). A possible model for understanding the personality-intelligence interface. *British Journal of Psychology*, *95*(2), 249–264.

Chapman, B., Duberstein, P., Tindle, H. A., Sink, K. M., Robbins, J., Tancredi, D. J., & Gingko Evaluation of Memory Study Investigators. Personality predicts cognitive function over 7 years in older persons. *The American Journal of Geriatric Psychiatry*, *20*(7), 612–621.

Chapman, B. P., Benedict, R. H., Lin, F., Roy, S., Federoff, H. J., & Mapstone, M. (2017). Personality and performance in specific neurocognitive domains among older persons. *The American Journal of Geriatric Psychiatry*, *25*(8), 900–908.

Cohen, M. (2012). The importance of self-regulation for college student learning. *College Student Journal*, *46*(4), 892–902.

Corrigan, J. D., & Hinkeldey, N. S. (1987). Relationships between parts A and B of the Trail Making Test. *Journal of Clinical Psychology*, *43*(4), 402–409.

Costa, P. T., & McCrae, R. R. (1999). A five-factor theory of personality. The Five-Factor model of personality. *Theoretical Perspectives*, *2*, 51–87.

Crespo-Sanmiguel, I., Zapater-Fajarí, M., Garrido-Chaves, R., Hidalgo, V., & Salvador, A. (2024). Subjective memory complaints in young people; their relationship with objective cognitive performance and the role of neuroticism. *Anales de Psicología/Annals of Psychology*, *40*(2), 323–334.

Crittenden, B. M., Mitchell, D. J., & Duncan, J. (2015). Recruitment of the default mode network during a demanding act of executive control. *eLife*, *4*, e06481.

Crow, A. J. (2019). Associations between neuroticism and executive function outcomes: Response inhibition and sustained attention on a continuous performance test. *Perceptual and Motor Skills*, *126*(4), 623–638.

Douglas, H. E., Cunningham, M. L., Tisdell, J., & Arneson, J. (2023). The problem with confidence: Too much and too little results in poorer

achievement, inner conflict, and social inhibition. *Frontiers in Psychology*, *14*, 960013.
Dubey, S., Singh, I. L., & Srivastava, S. (2014). Effect of personality on working memory capacity. *Indian Journal of Positive Psychology*, *5*(2), 150.
Erdfelder, E., Faul, F., & Buchner, A. (1996). GPOWER: A general power analysis program. *Behavior Research Methods, Instruments & Computers*, *28*(1), 1–11.
Fleming, K. A., Heintzelman, S. J., & Bartholow, B. D. (2016). Specifying associations between conscientiousness and executive functioning: Mental set shifting, not prepotent response inhibition or working memory updating. *Journal of Personality*, *84*(3), 348–360.
Flory, K., Lynam, D., Milich, R., Leukefeld, C., & Clayton, R. (2002). The relations among personality, symptoms of alcohol and marijuana abuse, and symptoms of comorbid psychopathology: Results from a community sample. *Experimental and Clinical Psychopharmacology*, *10*(4), 425–34.
Forbes, C. E., Poore, J. C., Krueger, F., Barbey, A. K., Solomon, J., & Grafman, J. (2014). The role of executive function and the dorsolateral prefrontal cortex in the expression of neuroticism and conscientiousness. *Social Neuroscience*, *9*(2), 139–151.
Friedman, N. P., du Pont, A., Corley, R. P., & Hewitt, J. K. (2018). Longitudinal relations between depressive symptoms and executive functions from adolescence to early adulthood: A twin study. *Clinical Psychological Science*, *6*(4), 543–560.
Gaillard, W. D., Sachs, B. C., Whitnah, J. R., Ahmad, Z., Balsamo, L. M., Petrella, J. R., & Grandin, C. B. (2003). Developmental aspects of language processing: FMRI of verbal fluency in children and adults. *Human Brain Mapping*, *18*(3), 176–185.
Goldstein, S., & Naglieri, J. A. (2014). *Executive functioning*. Springer.
Graham, E. K., & Lachman, M. E. (2014). Personality traits, facets and cognitive performance: Age differences in their relations. *Personality and Individual Differences*, *59*, 89–95.
Gray, J. R. (2001). Emotional modulation of cognitive control: Approach-withdrawal states double-dissociate spatial from verbal two-back task performance. *Journal of Experimental Psychology: General*, *130*(3), 436–52.
Hall, P. A., & Fong, G. T. (2013). Conscientiousness versus executive function as predictors of health behaviors and health trajectories. *Annals of Behavioral Medicine*, *45*(3), 398–399.
Herrmann, W., & Wacker, J. (2021). The selective dopamine D2 blocker sulpiride modulates the relationship between agentic extraversion and executive functions. *Cognitive, Affective, & Behavioral Neuroscience*, *21*(4), 852–867.
Hubbard, K., Reohr, P., Tolcher, L., & Downs, A. (2018). Stress, mental health symptoms, and help-seeking in college students. *Psi Chi Journal of Psychological Research*, *23*, 293–305
IBM Corp. 2020). *IBM SPSS Statistics for Windows, Version 27.0*. IBM Corp.
Ihle, A., Zuber, S., Gouveia, É.R., Gouveia, B. R., Mella, N., Desrichard, O., & Kliegel, M. (2019). Cognitive reserve mediates the relation between openness to experience and smaller decline in executive functioning. *Dementia and Geriatric Cognitive Disorders*, *48*(1-2), 39–44.
Jensen-Campbell, L. A., Rosselli, M., Workman, K. A., Santisi, M., Rios, J. D., & Bojan, D. (2002). Agreeableness, conscientiousness, and effortful control processes. *Journal of Research in Personality*, *36*(5), 476–489.
John, O. P., Donahue, E. M., & Kentle, R. L. (1991). *Big Five Inventory (BFI) [Database record]*. APA PsycTests.
Karaman, M. A., Lerma, E., Vela, J. C., & Watson, J. C. (2019). Predictors of academic stress among college students. *Journal of College Counseling*, *22*(1), 41–55.
Keen, L., George, L., Williams, G., Blanden, G., & Ramirez, M. (2022). Assessing the validity of the Self-Report Webexec Questionnaire: Self-report vs performance neurocognitive inferences. *Applied Neuropsychology: Adult*, *29*(5), 1030–1038.
Keen, L., II, Tan, A. Y., & Abbate, A. (2020). Inverse associations between parasympathetic activity and cognitive flexibility in African Americans: Preliminary findings. *International Journal of Psychophysiology*, *155*, 204–209.
Keen, L., Turner, A. D., Mwendwa, D., Callender, C., & Campbell, A. (2015). Depressive symptomatology and respiratory sinus arrhythmia in a non-clinical sample of middle-aged African Americans. *Biological Psychology*, *108*, 56–61.
Kidwell, K. S. (2005). Understanding the college first-year experience. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, *78*(6), 253–256.
Klojčnik, M., Kavcic, V., & Bakracevic Vukman, K. (2017). Relationship of depression with executive functions and visuospatial memory in elderly. *The International Journal of Aging and Human Development*, *85*(4), 490–503.
Kochanska, G., Aksan, N., Penney, S. J., & Doobay, A. F. (2007). Early positive emotionality as a heterogenous trait: Implications for children's self-regulation. *Journal of Personality and Social Psychology*, *93*(6), 1054–1066.
Krieger, V., Amador-Campos, J. A., & Guàrdia-Olmos, J. (2020). Executive functions, Personality traits and ADHD symptoms in adolescents: A mediation analysis. *Plos One*, *15*(5), e0232470.
Krogh, J., Benros, M. E., Jørgensen, M. B., Vesterager, L., Elfving, B., & Nordentoft, M. (2014). The association between depressive symptoms, cognitive function, and inflammation in major depression. *Brain, Behavior, and Immunity*, *35*, 70–76.
Lange, F., & Dewitte, S. (2019). Cognitive flexibility and pro-environmental behaviour: A multimethod approach. *European Journal of Personality*, *33*(4), 488–505.
Lee, D. K. (2016). Alternatives to P value: Confidence interval and effect size. *Korean Journal of Anesthesiology*, *69*(6), 555–562.
Lin, J., Li, L., Pan, N., Liu, X., Zhang, X., Suo, X., & Gong, Q. (2023). Neural correlates of neuroticism: A coordinate-based meta-analysis of resting-state functional brain imaging studies. *Neuroscience & Biobehavioral Reviews*, *146*, 105055.
Luchetti, M., Terracciano, A., Stephan, Y., & Sutin, A. R. (2016). Personality and cognitive decline in older adults: Data from a longitudinal sample and meta-analysis. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *71*(4), 591–601.
McKee, J. (2017). *Executive functions and resilience in first-year undergraduate students*. ProQuest Dissertations and Theses.
Mercuri, G., & Holtzer, R. (2021). Engagement in cognitively stimulating activities mediates the relationship between openness and attention/executive functions, but not memory in older adults. *Archives of Clinical Neuropsychology*, *36*(4), 485–497.
Murdock, K. W., Oddi, K. B., & Bridgett, D. J. (2013). Cognitive correlates of personality: Links between executive functioning and the big five personality traits. *Journal of Individual Differences*, *34*(2), 97.
Muris, P., Roelofs, J., Rassin, E., Franken, I., & Mayer, B. (2005). Mediating effects of rumination and worry on the links between neuroticism, anxiety and depression. *Personality and Individual Differences*, *39*(6), 1105–1111.
Nikolašević, Ž., Krstić, T., Rajšli, A., & Bugarski Ignjatović, V. (2024). The relationship between behavior aspects of executive functions and personality traits in healthy young adults. *Psychological Reports*, *127*(3), 1317–1335.
Pearman, A. (2009). Basic cognition in adulthood: Combined effects of sex and personality. *Personality and Individual Differences*, *47*(4), 357–362.
Perkovic, S. J., & Pechenkov, I. G. (2023). Personality predictors of anhedonia and depression: The role of the big five, autonomy, and sociotropy. *Personality and Individual Differences*, *208*, 112158.
Reitan, R. M. (1956). *Trail making test. Manual for administration, scoring, and interpretation*. Indiana University Press.
Rickham, P. P. (1964). Human experimentation. Code of Ethics of the World Medical Association. Declaration of Helsinki. *British Medical Journal*, *2*(5402), 177–177.
Robinson, M. D. (2007). Personality, affective processing, and self-regulation: Toward process-based views of extraversion, neuroticism, and agreeableness. *Social and Personality Psychology Compass*, *1*(1), 223–235.
Sampaio, A., Soares, J. M., Coutinho, J., Sousa, N., & Gonçalves, Ó.F. (2014). The Big Five default brain: Functional evidence. *Brain Structure and Function*, *219*(6), 1913–1922.
Samuel, D. B., & Widiger, T. A. (2011). Conscientiousness and obsessive-compulsive personality disorder. *Personality Disorders: Theory, Research, and Treatment*, *2*(3), 161.
Saylik, R., Szameitat, A. J., & Cheeta, S. (2018). Neuroticism related differences in working memory tasks. *PloS One*, *13*(12), e0208248.
Schretlen, D. J., van der Hulst, E.-J., Pearlson, G. D., & Gordon, B. (2010). A neuropsychological study of personality: Trait openness in relation to

https://doi.org/10.1017/S135561772400047X Published online by Cambridge University Press

intelligence, fluency, and executive functioning. *Journal of Clinical and Experimental Neuropsychology*, *32*(10), 1068–1073.
Segel-Karpas, D., & Lachman, M. E. (2018). Social contact and cognitive functioning: The role of personality. *The Journals of Gerontology: Series B*, *73*(6), 974–984.
Snyder, H. R. (2013). Major depressive disorder is associated with broad impairments on neuropsychological measures of executive function: A meta-analysis and review. *Psychological Bulletin*, *139*(1), 81–132.
Soubelet, A. (2011). Age-cognition relations and the personality trait of conscientiousness. *Journal of Research in Personality*, *45*(6), 529–534.
Speed, D., Hemani, G., Speed, M. S., Børglum, A. D., & Østergaard, S. D. (2019). Investigating the causal relationship between neuroticism and depression via Mendelian randomization. *Acta Psychiatrica Scandinavica*, *139*(4), 395–397.
Stafford, L. D., Ng, W., Moore, R. A., & Bard, K. A. (2010). Bolder, happier, smarter: The role of extraversion in positive mood and cognition. *Personality and Individual Differences*, *48*(7), 827–832.
Strough, J., Karns, T. E., & Schlosnagle, L. (2011). Decision-making heuristics and biases across the life span. *Annals of the New York Academy of Sciences*, *1235*(1), 57–74.
Studer-Luethi, B., Jaeggi, S. M., Buschkuehl, M., & Perrig, W. J. (2012). Influence of neuroticism and conscientiousness on working memory training outcome. *Personality and Individual Differences*, *53*(1), 44–49.
Sutin, A. R., Aschwanden, D., Stephan, Y., & Terracciano, A. (2022). The association between facets of conscientiousness and performance-based and informant-rated cognition, affect, and activities in older adults. *Journal of Personality*, *90*(2), 121–132.
Sutin, A. R., Stephan, Y., Damian, R. I., Luchetti, M., Strickhouser, J. E., & Terracciano, A. (2019). Five-factor model personality traits and verbal fluency in 10 cohorts. *Psychology and Aging*, *34*(3), 362–373.
Sutin, A. R., Stephan, Y., Luchetti, M., & Terracciano, A. (2019). Five-factor model personality traits and cognitive function in five domains in older adulthood. *BMC Geriatrics*, *19*(1), 1–10.
Tanji, J., & Hoshi, E. (2008). Role of the lateral prefrontal cortex in executive behavioral control. *Physiological Reviews*, *88*(1), 37–57.
Teixeira, C. M., Pomedli, S. R., Maei, H. R., Kee, N., & Frankland, P. W. (2006). Involvement of the anterior cingulate cortex in the expression of remote spatial memory. *Journal of Neuroscience*, *26*(29), 7555–7564.
Turkstra, L. S., & Byom, L. J. (2010). Executive functions and communication in adolescents. *The ASHA Leader*, *15*(15), 8–11.
Vaughan, R. S., & Edwards, E. J. (2020). Executive function and personality: The moderating role of athletic expertise. *Personality and Individual Differences*, *161*, 109973.
Vinograd, M., Williams, A., Sun, M., Bobova, L., Wolitzky-Taylor, K. B., Vrshek-Schallhorn, S., & Craske, M. G. (2020). Neuroticism and interpretive bias as risk factors for anxiety and depression. *Clinical Psychological Science*, *8*(4), 641–656.
Waggel, S. E., Lipnicki, D. M., Delbaere, K., Kochan, N. A., Draper, B., Andrews, G., Sachdev, P. S., & Brodaty, H. (2015). Neuroticism scores increase with late-life cognitive decline. *International Journal of Geriatric Psychiatry*, *30*(9), 985–993.
Wang, X., Zhuang, K., Li, Z., & Qiu, J. (2022). The functional connectivity basis of creative achievement linked with openness to experience and divergent thinking. *Biological Psychology*, *168*, 108260.
Waris, O., Soveri, A., Lukasik, K. M., Lehtonen, M., & Laine, M. (2018). Working memory and the Big Five. *Personality and Individual Differences*, *130*, 26–35.
Williams, P. G., Suchy, Y., & Kraybill, M. L. (2010). Five-factor model personality traits and executive functioning among older adults. *Journal of Research in Personality*, *44*(4), 485–491.
Yoon, K. L., Maltby, J., & Joormann, J. (2013). A pathway from neuroticism to depression: Examining the role of emotion regulation. *Anxiety, Stress & Coping*, *26*(5), 558–572.

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