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Big Five personality traits and academic performance: A meta-analysis

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Abstract

Objective and Method: This meta-analysis reports the most comprehensive assessment to date of the strength of the relationships between the Big Five personality traits and academic performance by synthesizing 267 independent samples ($N = 413{,}074$) in 228 unique studies. It also examined the incremental validity of personality traits above and beyond cognitive ability in predicting academic performance.

Results: The combined effect of cognitive ability and personality traits explained 27.8% of the variance in academic performance. Cognitive ability was the most important predictor with a relative importance of 64%. Conscientiousness emerged as a strong and robust predictor of performance, even when controlling for cognitive ability, and accounted for 28% of the explained variance in academic performance. A significant moderating effect of education level was observed. The relationship of academic performance with openness, extraversion, and agreeableness demonstrated significantly larger effect sizes at the elementary/middle school level compared to the subsequent levels. Openness, despite its weak overall relative importance, was found to be an important determinant of student performance in the early years of school.

Conclusion: These findings reaffirm the critical role of personality traits in explaining academic performance through the most comprehensive assessment yet of these relationships.

KEYWORDS

academic performance, achievement, Big Five, cognitive ability, intelligence, meta-analysis, personality

1 | INTRODUCTION

Academic performance is deemed of critical importance for career paths, individual life trajectories, and lifelong success. It is also considered valuable as a societal outcome. Students who demonstrate positive academic outcomes tend to have better health and overall well-being and are remunerated significantly above their counterparts who fail to perform well at school (Organization for Economic Cooperation and Development [OECD], 2016). A substantial body of research has investigated factors contributing to academic performance. It has been well documented that cognitive resources such as general cognitive ability are among the best predictors of academic performance (Laidra et al., 2007). There is also a strong and growing interest on the role of non-cognitive factors in accounting for individual differences in academic performance (MacCann et al., 2019). One of the non-cognitive factors that have been systematically related to academic performance is personality (Richardson et al., 2012). With

the present study, the aim is to summarize the links between personality traits, as conceptualized by the Big Five model (John & Srivastava, 1999; McCrae & Costa, 1996), and academic performance.

Several meta-analyses have examined the extent to which personality traits correlate with academic performance (e.g., Gatzka & Hell, 2018; McAbee & Oswald, 2013; Poropat, 2009; Trapmann et al., 2007). These past meta-analyses have typically concentrated on only one personality trait (e.g., openness; Gatzka & Hell, 2018), a specific measure of performance (e.g., GPA; McAbee & Oswald, 2013), or a single educational level (e.g., postsecondary; Trapmann et al., 2007). Poropat's (2009) meta-analysis was comprehensive, aiming to retrieve the largest possible number of relevant studies. His study included 80 research reports published or presented prior to the end of 2007. Given that hundreds of new studies have been published since then, there is a strong need to undertake a new and larger-scale meta-analysis for comprehensive examination of the relations that the Big Five have with academic performance. The present meta-analysis is conducted to address this need. The first and major purpose is to *summarize relationships between Big Five personality traits and academic performance from studies conducted over the last 30 years*.

1.1 | The Big Five personality traits

Personality traits include relatively stable patterns of cognitions, beliefs, and behaviors. The Big Five model has functioned as the powerful theoretical framework to synthesize most of the variation in these patterns (McCrae & Costa, 1999). The roots of this model lie in two research traditions: the psycholexical approach and the questionnaire approach (De Raad & Perugini, 2002; John & Srivastava, 1999). The Big Five model was discovered and originally verified within psycholexical studies founded on the lexical hypothesis, which states that all personality traits are encoded in every natural language (Cattell, 1943; Goldberg, 1981, 1990). The words invented and used to describe individual differences are exactly the same with how the trait terms have been used in the lexical approach. Identification of personality traits in the lexical approach is guided by two criteria: *synonym frequency* (i.e., the more important is a personality attribute, the more synonyms are used to describe it within the language) and *cross-cultural universality* (i.e., the most phenotypic attributes are typically codified in terms in the languages of different cultures). Factor analysis has often been applied in efforts to reduce a large set of words referring to personality attributes to a smaller set of basic personality dimensions (Strus et al., 2014).

The questionnaire approach has made a significant contribution to the expansion of the Big Five, both conceptually and empirically. In this line of research, the five personality dimensions were operationalized in the questionnaires and their associations with other theoretical concepts have been studied (Digman, 1990; John & Srivastava, 1999). Although the conceptualizations of the five personality traits within the psycholexical and questionnaire approaches are slightly different (Saucier & Goldberg, 1996), strong convergence exists between the various five-factor models (De Raad & Perugini, 2002; Goldberg, 1990; John & Srivastava, 1999).

The Big Five personality traits are traditionally labeled as *openness* (a degree of intellectual curiosity, creativity, and preference for novelty and variety), *conscientiousness* (a tendency to show self-discipline, planning, and organization), *extraversion* (positive emotions, activity, sociability, and the tendency to seek stimulation in the company of others), *agreeableness* (a tendency to be prosocial and cooperative toward others rather than antagonistic), and *neuroticism* (a vulnerability to unpleasant emotions such as anxiety, anger, and depression). These traits have been extensively studied in various research contexts including schools, universities, and other learning settings.

1.2 | The Big Five and academic performance

The effect of personality traits on academic performance is a well-documented empirical fact (Mammadov et al., 2018; Caprara et al., 2011; Gatzka & Hell, 2018). Of the Big Five, conscientiousness has emerged as a strong and consistent predictor, with correlation coefficients up to 0.57 (Mitrofan & Ion, 2013). Conscientious students tend to be self-disciplined, organized, and effective at carrying out tasks (McCrae & John, 1992). These characteristics are expected to enhance student performance in examinations, tests, and other types of evaluation measures. Openness has been reported to have from weak to moderate positive effects on performance in many studies (Caprara et al., 2011; Carretta & Ree, 2019; Gerbino et al., 2018). There are also some studies reporting negative associations between openness and performance (Furnham et al., 2006; Schmitt et al., 2011; Steinmayr & Kessels, 2017). Correlations reported in previous meta-analyses ranged from 0.06 to 0.13 with the confidence intervals not including zero, indicating a statistically significant positive mean effect of openness on academic performance (McAbee & Oswald, 2013; O'Connor & Paunonen, 2007; Poropat, 2009; Richardson et al., 2012; Trapmann et al., 2007; Vedel, 2014). The positive associations of openness with other performance-related outcomes such as approach to learning (Vermetten et al., 2001), autonomous motivation (Authors, in press), and critical thinking (Bidjerano & Dai, 2007) provide a strong rationale for its importance for student success.

The findings for the other personality traits are mixed and generally inconclusive. While many studies found negative associations between neuroticism and academic performance (Biderman & Reddock, 2012; Chamorro-Premuzic & Furnham, 2003a, 2003b; Gerbino et al., 2018), a large number of other studies reported positive significant correlations (Culjak & Mlacic, 2014; Lounsbury et al., 2005; Steele-Johnson & Leas, 2013). The negative effect of neuroticism seems theoretically more plausible as students with high scores on this trait tend to demonstrate higher levels of anxiety and stress that, in turn, can result in poor academic performance on exams or other assessments (Ackerman et al., 2011; O'Connor & Paunonen, 2007). Theoretically it is less clear how agreeableness and extraversion affect performance. Empirically there is weak evidence for their practical significance. One widely acknowledged argument is that their influence occurs indirectly through some mediating variables (Richardson et al., 2012; Woodfield et al., 2006). Given that agreeableness and extraversion are both interpersonal traits, their relationships with performance might be related to the way student performance is measured. For example, students who share, listen, and cooperate in a classroom setting may get high performance evaluations in group course projects. A human evaluator can be biased by student personalities.

1.3 | Moderators

The second purpose of the present meta-analysis is *to examine the influence of moderators on the calculated mean effect sizes*. Several features of the original studies are used to examine systematic differences in effect sizes across studies. Candidate moderators include education level, personality measurement type, gender composition, student age, and publication status.

1.3.1 | Education level

The strength of association between the Big Five traits and academic performance may change depending on the level of education (elementary/middle [K-8], secondary, or postsecondary). The increasing diversity of assessment practices in postsecondary education could be seen as a reason for possible changes. While student performance at elementary school is assessed based on a standard curriculum, it tends to widely vary at subsequent levels of education (Tatar, 1998). Results from previous studies suggest that the associations between performance and all personality traits, except conscientiousness, continue to decline from elementary to secondary and postsecondary education (Poropat, 2009). The present meta-analysis revisits a moderating effect of education level with a much larger sample. While most of the patterns of changes from Poropat's (2009) study are expected to be observed, specific differences are likely to occur along with the changes in the magnitude of effect sizes.

1.3.2 | Personality measurement types

Various personality instruments have been developed and used to study the Big Five in the context of academic performance. For the present meta-analysis, the criterion-related validity of the six most widely used measures was examined: the Big Five Inventory (BFI; John et al., 1991), the Big Five Questionnaire (BFQ; Caprara et al., 1993), the International Personality Item Pool (IPIP, Goldberg, 1999), Goldberg's (1992) unipolar Markers (and it's shortened versions, i.e., Mini-Markers), the NEO Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1992), and the NEO Personality Inventory—Revised (NEO-PI-R; Costa & McCrae, 1992).

The BFI is a 44-item instrument, developed to measure the dimensions of the Big five identified by Costa and McCrae (1992). The BFQ is composed of 132 items, developed to distinguish between the Big Five traits, each of which consists of 24 items. The IPIP is an extensive public-domain collection of personality items that has been developed as a result of ongoing collaborative effort. There are many scales that have been constructed from the items. The most widely used ones are 50-item and 100-item measures (Goldberg, 1999). Goldberg's (1992) unipolar Markers and its brief version, Mini-Markers (Saucier, 1994) are set of adjectives developed for the Big Five structure found in phenotypic personality description. The NEO-PI-R is a 240-item instrument reflecting the dimensions of the Big Five (48 items for each) and 30 lower order facets (six facets per trait). Finally, the NEO Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1992) is a shorter version of the NEO-PI-R, comprised of 60 items to measure the higher order factors only.

These instruments have subtle as well as some fairly obvious differences. Conceptualization of traits may differ across measures. For example, the IPIP and Goldberg's Markers label the openness trait as intellect, include items primarily associated with intellectual orientation (e.g., imagination, curiosity), and exclude several facets of the broader openness construct such as artistic interest and liberalism (McAbee & Oswald, 2013). Another important feature of the IPIP scales, different from the other popular measures, is that the agreeableness domain focuses on empathy and interest, and lacks items referring to quarrelsomeness (Thalmayer et al., 2011). The item contents and response formats vary too. Some instruments (e.g., BFI, NEO-PI-R, IPIP) provide information by, for example, including context to help the respondents interpret an item. Other instruments such as the Markers include adjectives only. The Markers also include more items reflecting organization and orderliness facets of conscientiousness

than the performance-striving facet (Noftle & Robins, 2007). One might expect to observe weaker correlations between conscientiousness and performance when these scales are used as a personality measure compared with those including more performance-striving-related items (McAbee & Oswald, 2013). These differences are considered as potential sources of variation in effect sizes across studies that use different personality measures.

1.3.3 | Geographical regions of studies

The sample of studies examining the personality–academic performance relationships is internationally diverse. One limitation of the body of the literature on this topic is that most of these studies have been carried out with WEIRD (Western, educated, industrialized, rich, and democratic) samples. To our knowledge, no study has yet explicitly theorized and examined cross-cultural variability on the relationship between personality and academic performance. It is possible that academic performance reflects personality differently across countries, cultures and/or geographical regions. Testing geographical regions as additional moderator was included as an exploratory purpose in the present meta-analysis. To that end, results from six regions were compared: North America (Canada, the United States), Australia, Western Europe, Eastern Europe and Russia, Middle East, and Asia. These regions were considered to best represent countries of origin of primary studies included in this investigation.

1.3.4 | Gender composition

The way gender composition could moderate the relationship between personality and academic performance is related to the gender effects at the individual level of analysis. There is some evidence to support gender differences in performance-related student characteristics (Spinath et al., 2014). However, no consistent findings have been reported to specifically show that the Big Five predict performance differently for male and female students (Freudenthaler et al., 2008; Steinmayr & Spinath, 2008). Only few studies examined the association of gender differences in performance with personality (Hicks et al., 2008; Nguyen et al., 2005; Spinath et al., 2010). Spinath et al.'s (2010), in their study with Austrian eight graders, reported that female students' grades were positively associated with openness, conscientiousness, and extraversion, and negatively with neuroticism in three different subjects (math, German, and English). For male students, by contrast, the only significant association was observed between math grades and conscientiousness. Nguyen et al. (2005) investigated the moderating role of gender in the relationship between personality traits and performance among university students. Openness and emotional stability (the opposite of neuroticism) significantly and positively predicted performance among male students, but the same relationships were nonexistent among female students. Despite the limited number of studies, gender appears as an important potential moderator to be tested in the present meta-analysis.

1.3.5 | Age

A rationale for including age as a candidate moderator is similar to that for education level. Previous studies have suggested that the strength of associations between personality traits and academic performance change as students advance through the education system (Poropat, 2009). Therefore, the moderating effect of age is expected to be parallel to the changes associated with education level. There is, however, a notable difference that warrants the inclusion of age as a separate moderator. Education level defines the broader context in which the relationship between student personality and performance may change as a function of contextual effects. Education level serves as a categorical variable. Results will yield relative magnitude of the mean effects, which could be used for comparison purposes. Age, however, is continuous; and may have implications that reflect dynamic developmental processes.

1.3.6 | Publication status

Publishing practices in scientific journals may result in a selection bias (Open Science Collaboration, 2015). Reported effect sizes could be systematically larger in published studies than those remained unpublished. In other words, studies that report relatively strong effects are more likely to find their way to peer-reviewed publications compared with those with weak or non-significant findings. In addition to performing a thorough search to include all relevant reports, the present meta-analysis assesses the likely impact of this bias by examining differences between published studies and unpublished data (dissertations, conference proceedings).

1.4 | Incremental validity of the Big Five for academic performance

The third purpose of this study *was to examine incremental validity of the Big Five personality traits above and beyond cognitive ability in predicting performance*. It is well established that cognitive ability is an essential ingredient for student success (Laidra et al., 2007; Tikhomirova et al., 2020). Both basic cognitive processes, such as number sense and information processing speed (Luo et al., 2006), and

higher-order cognitive processes, such as fluid intelligence (Deary et al., 2007; Geary, 2011), have been consistently found to be related to academic performance. Given that cognitive ability is the best predictor of performance (Rohde & Thompson, 2007), it is important to test incremental validity of the Big Five alongside the contribution of this traditional predictor. Of the Big Five, conscientiousness emerged as a significant predictor of academic performance independently of the effect of intelligence (Poropat, 2009). The present meta-analysis seeks to determine which Big Five personality traits provide incremental prediction above and beyond the effect of cognitive ability. In addition, the relative importance of each predictor is examined.

2 | METHOD

2.1 | Literature search

The literature search using a multimodal strategy sought to identify any study that reported a correlation between the Big Five and academic performance. First, the database search was performed using a combination of key terms in PsycINFO, Scopus, ERIC, and ProQuest Dissertations & Theses to identify articles that included (a) at least one personality-related keyword indicating that the Big Five was used, which included any personality trait (e.g., openness, conscientiousness) or a common measure name (e.g., NEO, Big Five, Big 5, FFM, BFI, etc.), (b) the word personality, and (c) academic performance or a related term (academic performance, academic success, etc.). The search terms were applied to article titles, abstracts, and search headings. Second, references from key meta-analyses on personality and performance-related outcomes were used (e.g., Poropat, 2009; Vedel, 2014). Citations that were included in the previous meta-analyses as unpublished studies checked for later publication. Unpublished duplicates of published studies were removed (e.g., Hirsh, 2006; Hirsh & Peterson, 2008). Third, forward citation searching was employed by searching articles that cited included studies. Figure 1 presents an overview of the search process. Overall, the search yielded 10,775 articles. Obvious duplicates ($n = 3363$) were removed after merging these sources. An additional 7015 articles were excluded at the title and abstract levels due to their irrelevancy to the present study. This resulted in the retention of 397 articles for further examination for eligibility and inclusion. Searches were conducted in September, 2020 and included the years 1990 to 2020. A summary of the studies included in the meta-analysis is presented in Table 1.

2.2 | Inclusion criteria

Studies were included if they measured personality traits and academic performance using scales that yielded quantitative values, measured Big Five personality traits, measured academic performance through grades, exam performance, GPA, or standardized performance tests, were in English, were a

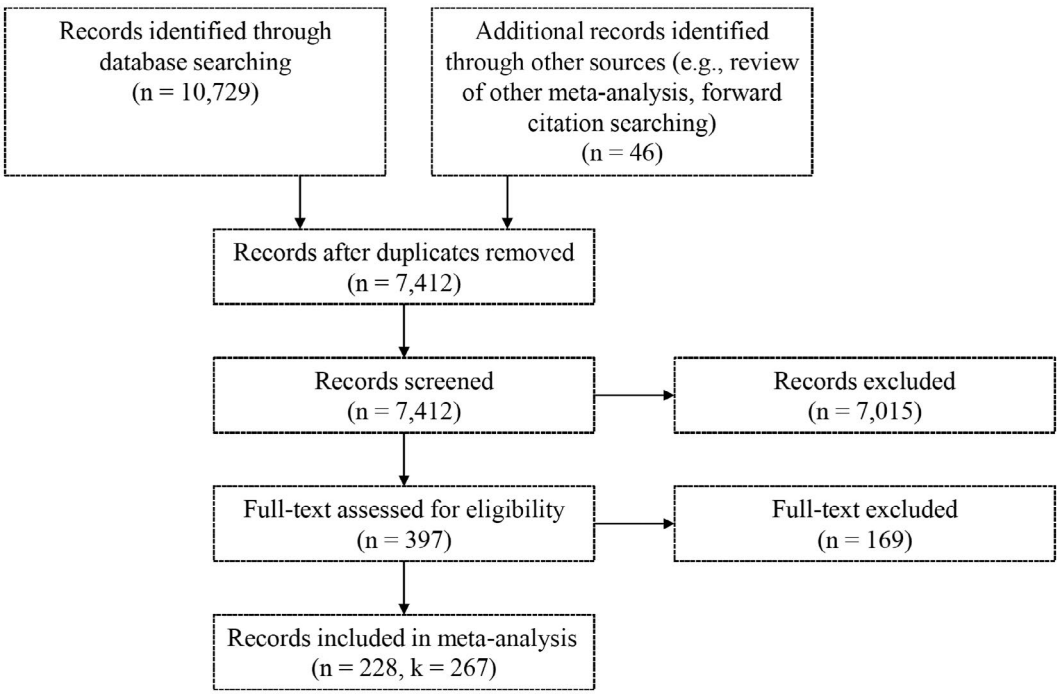

FIGURE 1 Preferred reporting items for systematic reviews and meta-analysis (PRISMA) diagram illustrating study selection. *k*, total number of independent samples; *n*, number of record

TABLE 1 Summary of studies included in meta-analysis

	Study	*N*	Female %	Age	Education level	Country	Personality measure	Publication status
1	Aguilar (2013)	79	68.4	29	Postsecondary	US	BFI	Not published
2	Al Qaisy and Thawabieh (2017)	304	54.9		Postsecondary	Jordan	BFI	Published
3	Alkis and Temizel (2018)	127	59.8	22.03	Postsecondary	Turkey	BFI	Published
4	Andersen et al. (2020) s1	45,135			Elementary/middle	Denmark	BFI	Published
5	Andersen et al. (2020) s2	47,305			Elementary/middle	Denmark	BFI	Published
6	Andersen et al. (2020) s3	42,949			Elementary/middle	Denmark	BFI	Published
7	Andrei et al. (2015) s1	376	51.86	9.39	Elementary/middle	Italy	BFQ	Published
8	Andrei et al. (2015) s2	202	52.97	12.05	Elementary/middle	Italy	BFQ	Published
9	Anglim et al. (2018) s1	530	55	24.9	Postsecondary	Australia	NEO-PI-R	Published
10	Anglim et al. (2018) s2	539	62	18.25	Postsecondary	Belgium	NEO-PI-R	Published
11	Anticevic et al. (2018)	250	78.8	22.3	Postsecondary	Croatia	BFQ	Published
12	Bahcekapili and Karaman (2020)	525	38.09	30.9	Postsecondary	Turkey	BFI	Published
13	Barbaranelli et al. (2003)	968	46.69	12.42	Secondary	Italy	BFQ	Published
14	Barchard (2003)	150	62.66	21.5	Postsecondary	US	IPIP	Published
15	Barta et al. (2018)	154	65.58	12.25	Secondary	Romania	BFI	Published
16	Bartone et al. (2002)	855	12	18.61	Postsecondary	US	Other	Published
17	Bauer and Liang (2003)	265	58.5		Postsecondary	US	NEO-FFI	Published
18	Bergold and Steinmayr (2018) s1	421	49.4	16.43	Secondary	Germany	NEO-FFI	Published
19	Bergold and Steinmayr (2018) s2	243	44.86	16.53	Secondary	Germany	NEO-PI-R	Published
20	Berings et al. (2013)	233	36		Postsecondary	Belgium	Other	Published
21	Biderman and Reddock (2012)	203	68.93	19.32	Postsecondary	US	IPIP	Published
22	Bidjerano and Dai (2007)	219	72	22	Postsecondary	US	Markers	Published
23	Brandt et al. (2020) s1	3373	49	15.2	Secondary	Germany	BFI	Published
24	Brandt et al. (2020) s2	4508	49	15.2	Secondary	Germany	BFI	Published
25	Brandt et al. (2020) s3	5034	49	15.2	Secondary	Germany	BFI	Published
26	Bratko et al. (2006)	255	65.49	16.2	Secondary	Croatia	Other	Published
27	Burgard (2000)	117	79	22	Postsecondary	US	NEO-FFI	Not published
28	Burton and Nelson (2006)	97	73.19	28.12	Postsecondary	Australia	IPIP	Published
29	Busato et al. (2000)	409			Postsecondary	Netherlands	Other	Published
30	Camps and Morales-Vives (2013)	232	53.02	15.5	Secondary	Spain	Other	Published
31	Cao and Meng (2020)	555	33.9	19.5	Postsecondary	China	Other	Published

(Continues)

TABLE 1 (Continued)

	Study	*N*	Female %	Age	Education level	Country	Personality measure	Publication status
32	Caprara et al. (2004) s1	240	0	11.39	Secondary	Italy	BFQ	Published
33	Caprara et al. (2004) s2	249	100	11.39	Secondary	Italy	BFQ	Published
34	Caprara et al. (2011)	412	52.42	13	Secondary	Italy	BFQ	Published
35	Cárdenas Moren et al. (2020)	235		19	Postsecondary	Chile	NEO-FFI	Published
36	Caretta and Ree (2019) s1	16,109			Postsecondary	US	Other	Published
37	Caretta and Ree (2019) s2	29,383			Postsecondary	US	Other	Published
38	Carretta and Ree (2019) s3	62,592			Postsecondary	US	Other	Published
39	Cela-Ranilla et al. (2011)	509	63.5	18.78	Postsecondary	Spain	Other	Published
40	Chamorro-Premuzic and Furnham (2003a)	247	72.47	20.1	Postsecondary	UK	NEO-PI-R	Published
41	Chamorro-Premuzic and Furnham (2003b)	70	70	19.8	Postsecondary	UK	NEO-FFI	Published
42	Chamorro-Premuzic and Furnham (2008)	158	70	19.21	Postsecondary	UK	NEO-PI-R	Published
43	Chamorro-Premuzic (2006)	104	75.96	19.98	Postsecondary	UK	NEO-FFI	Published
44	Chamorro-Premuzic (2006)	307	60.91	19.76	Postsecondary	UK	NEO-FFI	Published
45	Chapa (2016)	198	66	23	Postsecondary	US	NEO-FFI	Not published
46	Chapman and Hayslip (2005)	292	74.3	19.68	Postsecondary	US	NEO-FFI	Published
47	Cheng and Ickes (2009)	377	71.61	18.72	Postsecondary	US	BFI	Published
48	Chowdhury (2006)	130	56		Postsecondary	US	Other	Published
49	Clark (2007)	80	30		Postsecondary	US	NEO-PI-R	Not published
50	Colquitt and Simmering (1998)	103			Postsecondary	US	NEO-FFI	Published
51	Conard (2006)	300	77.66	19.48	Postsecondary	US	NEO-FFI	Published
52	Conrad and Patry (2012)	223	63.22		Postsecondary	Canada	NEO-FFI	Published
53	Cucina and Vasilopoulos (2005)	262	76	19	Postsecondary	US	IPIP	Published
54	Culjak and Mlacic (2014) s1	41	100	16.5	Secondary	Bosnia	IPIP	Published
55	Culjak and Mlacic (2014) s2	59	100	16.5	Secondary	Bosnia	IPIP	Published
56	Day et al. (2003)	384	55	18.91	Postsecondary	US	Markers	Published
57	Day et al. (2010)	129	59.68	18.56	Postsecondary	UK	IPIP	Published
58	de Bruin et al. (2005)	82	96.34		Secondary	South Africa	Other	Published
59	De Feyter et al. (2012)	375	40	18.59	Postsecondary	Belgium	NEO-FFI	Published

(Continues)

TABLE 1 (Continued)

	Study	*N*	Female %	Age	Education level	Country	Personality measure	Publication status
60	De Fruyt and Mervielde (1996)	714	55.6	23.4	Postsecondary	Belgium	NEO-PI-R	Published
61	de Koning et al. (2012)	1753	74	20.04	Postsecondary	Netherlands	Other	Published
62	Debicki et al. (2016)	307	36.8	23	Postsecondary	US	IPIP	Published
63	Di Fabio and Busoni (2007)	286	56.3	17.83	Secondary	Italy	BFQ	Published
64	Di Giunta et al. (2013) s1	206	0		Secondary	Italy	BFQ	Published
65	Di Giunta et al. (2013) s2	220	100		Secondary	Italy	BFQ	Published
66	Ding et al. (2017)	104	73.08	29.26	Postsecondary	US	NEO-PI-R	Published
67	Diseth (2003) s1	151	76.82	21.4	Postsecondary	Norway	NEO-PI-R	Published
68	Diseth (2003) s2	164	64.02	20.2	Postsecondary	Norway	NEO-PI-R	Published
69	Diseth (2013)	70	55.71	21.2	Postsecondary	Norway	NEO-FFI	Published
70	Dollinger and Orf (1991)	90	73.33		Postsecondary	US	NEO-PI-R	Published
71	Dollinger et al. (2008)	338	61	21.9	Postsecondary	US	Other	Published
72	Duff et al. (2004)	146	74.6	24.3	Postsecondary	Scotland	Other	Published
73	Dumfart and Neubauer (2016)	361	47.37	14.09	Secondary	Australia	Other	Published
74	Durso-Finley (2016)	305	44.91		Secondary	US	Other	Not published
75	Dwight et al. (1998)	437	67	21.37	Postsecondary	US	Markers	Published
76	Dzubur et al. (2020)	95	82.11	19	Postsecondary	Bosnia	BFI	Published
77	Edwards and Schleicher (2004)	70	61.42	26.9	Postsecondary	US	Other	Published
78	Ehrler (2005)	87	39.08	13.26	Elementary/middle	US	BFQ	Not published
79	Eilam et al. (2009)	52	48.07		Secondary	Israel	NEO-PI-R	Published
80	Engel (2013)	88	70.5	18	Postsecondary	US	BFI	Not published
81	Fabris et al. (2019)	363	51.5	10.2	Elementary/middle	Italy	BFQ	Published
82	Farsides and Woodfield (2003)	432	52.31	21.3	Postsecondary	UK	NEO-FFI	Published
83	Ferguson et al. (2000)	176	58	19.7	Postsecondary	UK	Markers	Published
84	Fernandez (2019) s1	161	85.6	14.12	Secondary	US	Other	Not published
85	Fernandez (2019) s2	50	68	18.6	Postsecondary	US	Other	Not published
86	Freudenthaler et al. (2008) s1	552	0	13.74	Elementary/middle	Austria	BFI	Published
87	Freudenthaler et al. (2008) s2	801	100	13.74	Elementary/middle	Austria	BFI	Published
88	Fritzsche et al. (2002)	559	62	21.5	Postsecondary	US	NEO-PI-R	Published
89	Furnham and Chamorro-Premuzic (2004)	91	81.31	19.7	Postsecondary	UK	NEO-FFI	Published

(Continues)

TABLE 1 (Continued)

	Study	*N*	Female %	Age	Education level	Country	Personality measure	Publication status
90	Furnham et al. (2003)	93	75.27	19.3	Postsecondary	UK	NEO-PI-R	Published
91	Furnham et al. (2009)	212	58.02	15.8	Secondary	UK	NEO-FFI	Published
92	Furnham (2012) s1	178	80.9	19.41	Postsecondary	UK	NEO-FFI	Published
93	Furnham (2012) s2	93	80.65	18.9	Postsecondary	UK	NEO-FFI	Published
94	Furnham et al. (2006)	64	71.88		Postsecondary	UK	NEO-PI-R	Published
95	Garcia-Ruffin (2003)	74	77		Postsecondary	US	NEO-FFI	Not published
96	Geramian et al. (2012)	146	22	26	Postsecondary	Malaysia	BFI	Published
97	Gerbino et al. (2018) s1	165	51.5	12.93	Elementary/middle	Italy	BFQ	Published
98	Gerbino et al. (2018) s2	927	52	14	Elementary/middle	Italy	BFQ	Published
99	Gerhardt et al. (2007)	228	44	20.3	Postsecondary	US	IPIP	Published
100	Gilles and Bailleux (2001)	141	42.55	12	Elementary/middle	France	Other	Published
101	Goff and Ackerman (1992)	147	52.38		Postsecondary	US	NEO-PI-R	Published
102	Grama and Botone (2018)	751	70.43		Postsecondary	Romania	NEO-PI-R	Published
103	Gray and Watson (2002)	334	63.77	19.2	Postsecondary	US	NEO-PI-R	Published
104	Hair and Graziano (2003)	317	59.63		Elementary/middle	US	Markers	Published
105	Hair and Hampson (2006)	236	100	20.3	Postsecondary	UK	BFI	Published
106	Hakimi et al. (2011)	285	67.02		Postsecondary	Iran	NEO-FFI	Published
107	Hart (2016)	93	51.61		Elementary/middle	US	IPIP	Not published
108	Hashmi and Naz (2020)	1376	79		Postsecondary	Pakistan	BFI	Published
109	Hazrati-Viari et al. (2012)	217	45.16	23.03	Postsecondary	Iran	NEO-FFI	Published
110	Heaven and Ciarrochi (2012)	786	45.67	15.41	Secondary	Australia	IPIP	Published
111	Heaven et al. (2007)	666	50	12.3	Secondary	Australia	BFI	Published
112	Herrera et al. (2020)	407	52.8	10.74	Elementary/middle	Spain	BFQ	Published
113	Higgins et al. (2007) s1	121	55.37	20	Postsecondary	US	NEO-PI-R	Published
114	Higgins et al. (2007) s2	142	68.3	20.7	Postsecondary	Canada	NEO-PI-R	Published
115	Hirsh and Peterson (2008)	205	71.22	21	Postsecondary	Canada	BFI	Published
116	Homayouni (2011)	110			Postsecondary	Iran	NEO-FFI	Published
117	Hourieh et al. (2019)	151	21.2		Postsecondary	US	NEO-PI-R	Published
118	Jonkmann et al. (2012)	4973	55	19.57	Secondary	Germany	NEO-FFI	Published
119	Kaiser and Diewald (2014)	1116			Elementary/middle	US	BFI	Published
120	Kao and Craigie (2014)	164	51.82	18.8	Postsecondary	Taiwan	BFI	Published

(Continues)

TABLE 1 (Continued)

	Study	*N*	Female %	Age	Education level	Country	Personality measure	Publication status
121	Kappe and van der Flier (2010)	133	74	20	Postsecondary	Netherlands	NEO-FFI	Published
122	Katrimpouza et al. (2019) s1	19	100	20.03	Postsecondary	Greece	Markers	Published
123	Katrimpouza et al. (2019) s2	80	97.5	19	Postsecondary	Greece	Markers	Published
124	Katrimpouza et al. (2019) s3	46	97.82	20.6	Postsecondary	Greece	Markers	Published
125	Kaufman et al. (2008)	315	79	23.53	Postsecondary	US	IPIP	Published
126	Kelsen and Liang (2019)	441	61.45	20.52	Postsecondary	Taiwan	BFI	Published
127	Kertechian (2018)	404	74.8	20.45	Postsecondary	France	BFI	Published
128	Kessler (2002)	520	70	19.5	Postsecondary	US	NEO-PI-R	Not published
129	Kim and MacCann (2016) s1	137	58.39	19.85	Postsecondary	UK	Markers	Published
130	Kim and MacCann (2016) s2	378	73.8	19.11	Postsecondary	UK	Markers	Published
131	Kim et al. (2018)	2082	52.45	13.3	Elementary/middle	Australia	BFI	Published
132	Kirkagac and Oz (2017)	200	79.5		Postsecondary	Turkey	IPIP	Published
133	Komarraju et al. (2009)	308	52.3		Postsecondary	US	NEO-FFI	Published
134	Kornienko et al. (2018)	400	55	8.6	Elementary/middle	Russia	Other	Published
135	Koschmieder et al. (2018)	1120	60.26	20.89	Postsecondary	Germany	BFI	Published
136	Koseoglu (2016)	202		19	Postsecondary	Turkey	NEO-FFI	Published
137	Laidra et al. (2007) s1	2746	53.38	14.9	Secondary	Estonia	NEO-FFI	Published
138	Laidra et al. (2007) s2	1435	47.52	9.4	Elementary/middle	Estonia	NEO-FFI	Published
139	Laskey (2004)	105	67.62	24	Postsecondary	US	NEO-FFI	Not published
140	Lee and Sohn (2017)	235	53.4	20.9	Postsecondary	South Korea	IPIP	Published
141	Lee (2004)	393	45.55	22.4	Postsecondary	US	IPIP	Not published
142	Letourneau (2009)	73		17	Secondary	US	NEO-PI-R	Not published
143	Lievens and Coetsier (2002)	529	65.02	18.25	Postsecondary	Belgium	NEO-PI-R	Published
144	Lievens et al. (2002)	607	63.23	18.2	Postsecondary	Belgium	NEO-PI-R	Published
145	Lievens et al. (2008) s1	337	67	22	Postsecondary	Belgium	IPIP	Published
146	Lievens et al. (2008) s2	105	70	21	Postsecondary	Belgium	IPIP	Published
147	Lim and Melissa Ng Abdullah (2012)	360	50		Secondary	Malaysia	NEO-FFI	Published
148	Lipnevich et al. (2016) s1	179	71	22.6	Postsecondary	Germany	BFI	Published
149	Lipnevich et al. (2016) s2	202	77	19.3	Postsecondary	Belarus	BFI	Published
150	Lounsbury et al. (2003a)	290	47	12.6	Elementary/middle	US	Other	Published
151	Lounsbury et al. (2003b)	175	64	22.7	Postsecondary	US	Other	Published

(Continues)

TABLE 1 (Continued)

	Study	*N*	Female %	Age	Education level	Country	Personality measure	Publication status
152	Lounsbury et al. (2005)	434	58	19	Postsecondary	US	Other	Published
153	Lourinho et al. (2017)	181	65.7		Postsecondary	Portugal	NEO-FFI	Published
154	Loveland et al. (2007)	992	51	15.5	Secondary	US	Other	Published
155	Malykh (2017)	300	49.5	16	Secondary	Russia	NEO-PI-R	Published
156	Mammadov et al. (2018)	161	43.6		Middle and high	US	BFI	Published
157	Marcela (2015)	254	64.17	23.25	Postsecondary	Slovakia	NEO-FFI	Published
158	Marsh et al. (2006)	4475	55	18	Secondary	Germany	NEO-FFI	Published
159	McCredie and Kurtz (2020)	143	67.8	18.7	Postsecondary	US	NEO-FFI	Published
160	McKenzie et al. (2004)	1193	50.54	21.44	Postsecondary	Australia	NEO-FFI	Published
161	McKenzie (2000)	131	93.89	22.8	Postsecondary	US	NEO-FFI	Published
162	Medford and McGeown (2012)	295	51.53	10.64	Elementary/middle	UK	Other	Published
163	Meyer et al. (2019)	3171		19.92	Secondary	Germany	BFI	Published
164	Mitrofan and Ion (2013) s1	85	81.18	21.3	Postsecondary	Romania	NEO-PI-R	Published
165	Mitrofan and Ion (2013) s2	31	80.65	23.6	Postsecondary	Romania	BFQ	Published
166	Monteiro et al. (2015)	113	24.6	22.18	Postsecondary	Portugal	NEO-PI-R	Published
167	Moon and Illingworth (2005)	303	64	21.89	Postsecondary	US	Markers	Published
168	Morales-Vives et al. (2020)	305	52.13	15.7	Secondary	Spain	Other	Published
169	Moreira et al. (2012)	198	64.4	16.9	Secondary	Portugal	NEO-PI-R	Published
170	Musgrave-Marquart et al. (1997)	161	64	20.8	Postsecondary	US	NEO-PI-R	Published
171	Myers (2019)	103	62.1	39.46	Postsecondary	US	BFI	Not published
172	Naqshbandi et al. (2017)	1165			Postsecondary	Malaysia	Other	Published
173	Negru-Subtirica et al. (2020)	1151	58.7	16.45	Secondary	Romania	BFI	Published
174	Neuenschwander et al. (2013)	446	49	8.13	Elementary/middle	Switzerland	Other	Published
175	Nguyen et al. (2005)	368	51.4		Postsecondary	US	IPIP	Published
176	Noftle and Robins (2007) s1	10,497	63	19	Postsecondary	US	BFI	Published
177	Noftle and Robins (2007) s2	508	56	18	Postsecondary	US	NEO-FFI	Published
178	Noftle and Robins (2007) s3	470	78	19	Postsecondary	US	Other	Published
179	Noftle and Robins (2007) s4	425	61	19	Postsecondary	US	NEO-PI-R	Published
180	Novikova and Vorobyeva (2017)	207	80.19	19	Postsecondary	Russia	NEO-FFI	Published
181	Okun and Finch (1998)	240	84	18	Postsecondary	US	BFI	Published
182	Onder et al. (2014)	1343	62.8	21.01	Postsecondary	Turkey	Other	Published

(Continues)

TABLE 1 (Continued)

	Study	*N*	Female %	Age	Education level	Country	Personality measure	Publication status
183	Oswald et al. (2004)	621	72	18.5	Postsecondary	US	IPIP	Published
184	Oz (2015)	102	75	20.3	Postsecondary	Turkey	IPIP	Published
185	Palmisano (2017)	163			Postsecondary	US	NEO-FFI	Not published
186	Pang (2008)	125	68	24	Postsecondary	US	NEO-PI-R	Not published
187	Papageorgious et al. (2020)	1191	50.63	15.24	Secondary	Russia	BFI	Published
188	Parkinson and Taggar (2006)	305	52	21	Postsecondary	Canada	NEO-PI-R	Published
189	Parrigon (2013)	274	52.91	24.95	Postsecondary	US	IPIP	Not published
190	Paunonen and Ashton (2001)	717	73.5		Postsecondary	US	Other	Published
191	Paunonen (1998)	96	62.5	19.2	Postsecondary	US	Other	Published
192	Peeters and Lievens (2005)	293	81	20.6	Postsecondary	Belgium	NEO-FFI	Published
193	Perera et al. (2015)	498	62.4	17.87	Postsecondary	Australia	BFI	Published
194	Perry (2003)	2398	53.21		Secondary	US	Other	Not published
195	Petska (2006)	250	51.15		Postsecondary	US	NEO-FFI	Not published
196	Phillips et al. (2003)	165	80	22.9	Postsecondary	UK	NEO-FFI	Published
197	Poorthuis et al. (2014)	322	53	12.2	Elementary/middle	Netherlands	BFI	Published
198	Poropat (2011)	173	53	20.8	Postsecondary	Australia	Markers	Published
199	Purcell (2012)	200	64.5	18.8	Postsecondary	US	BFI	Not published
200	Ramalingam (2014)	124	92.74	19.35	Postsecondary	India	BFI	Published
201	Rascanu et al. (2017)	374	80.48		Postsecondary	Romania	NEO-PI-R	Published
202	Reddock et al. (2011)	329	60	21	Postsecondary	US	IPIP	Published
203	Richardson and Abraham (2009) s1	472	100	20.09	Postsecondary	UK	BFI	Published
204	Richardson and Abraham (2009) s2	142	0	20.83	Postsecondary	UK	BFI	Published
205	Ridgell and Lounsbury (2004)	140	46	19.18	Postsecondary	US	Other	Published
206	Rimfeld et al. (2016)	4642		16	Secondary	UK	Other	Published
207	Rode et al. (2007)	378	46	20.7	Postsecondary	US	Markers	Published
208	Rosander and Backstrom (2014)	197	47.71	16.01	Secondary	Sweden	IPIP	Published
209	Rosander et al. (2011)	315	50.16	16.02	Secondary	Sweden	IPIP	Published
210	Rothstein et al. (1994)	450	20.66		Postsecondary	Canada	Other	Published
211	Santo (2001)	40		26.47	Postsecondary	US	NEO-FFI	Not published
212	Saxena and Mishra (2014)	162	31.5	22.7	Postsecondary	India	IPIP	Published
213	Scepansky and Bjornsen (2003)	336	69.94	19.03	Postsecondary	US	NEO-PI-R	Published

(Continues)

TABLE 1 (Continued)

	Study	*N*	Female %	Age	Education level	Country	Personality measure	Publication status
214	Schmit et al. (1995)	99			Postsecondary	US	NEO-PI-R	Published
215	Schmitt et al. (2011) s1	315			Postsecondary	US	IPIP	Published
216	Schmitt et al. (2011) s2	338			Postsecondary	US	IPIP	Published
217	Shchebetenko (2016)	739	67.1	19.65	Postsecondary	Russia	BFI	Published
218	Siddiquei and Khalid (2018)	144	58.33		Postsecondary	Pakistan	BFI	Published
219	Smithers et al. (2004)	145	54	25.9	Postsecondary	Canada	NEO-PI-R	Published
220	Smith-Woolley et al. (2019)	8552		16.3	Secondary	UK	Other	Published
221	Saklofske et al. (2012)	238	77.73	20.03	Postsecondary	Scotland	Markers	Published
222	Song et al. (2020)	830	51.33	13.93	Middle and high	Germany	BFI	Published
223	Soric et al. (2017)	501	68.06	16.19	Secondary	Croatia	IPIP	Published
224	Spengler et al. (2016) s1	240		15.63	Secondary	Luxembourg	BFI	Published
225	Spengler et al. (2016) s2	276		15.97	Secondary	Luxembourg	BFI	Published
226	Spinath et al. (2010) s1	552	0	13.74	Secondary	Austria	BFI	Published
227	Spinath et al. (2010) s2	801	100	13.74	Secondary	Austria	BFI	Published
228	Steele-Johnson and Leas (2013)	719	69	19.75	Postsecondary	US	IPIP	Published
229	Steinmayr and Kessels (2017) s1	236	60.17	16.77	Secondary	Germany	NEO-FFI	Published
230	Steinmayr and Kessels (2017) s2	124	51.61	33.65	Postsecondary	Germany	NEO-FFI	Published
231	Steinmayr and Spinath (2008) s1	138	0	16.94	Secondary	Germany	NEO-FFI	Published
232	Steinmayr and Spinath (2008) s2	204	100	16.94	Secondary	Germany	NEO-FFI	Published
233	Steinmayr et al. (2011)	520	58.27	16.94	Secondary	Germany	NEO-FFI	Published
234	Sunbul (2019)	406	73.64	20.33	Postsecondary	Turkey	BFI	Published
235	Swanberg and Martinsen (2010)	687	56	24.8	Postsecondary	Norway	NEO-FFI	Published
236	Taher et al. (2011)	208	35	30.91	Postsecondary	China	IPIP	Published
237	Tetzner et al. (2019) s1	3658	48.8	11.68	Elementary/middle	Germany	BFI	Published
238	Tetzner et al. (2019) s2	2129	47.6	15.13	Secondary	Germany	BFI	Published
239	Thiele et al. (2018)	47	85.1	21.72	Postsecondary	Germany	BFI	Published
240	Tok and Morali (2009)	295	37.63	23.2	Postsecondary	Turkey	Other	Published
241	Troncone et al., (2014)	439	48.75	12.36	Secondary	Italy	BFQ	Published
242	Tross et al. (2000)	844	29.5		Postsecondary	US	Other	Published
243	Tucker-Drob et al. (2016)	811		10.91	Elementary/middle	US	BFI	Published
244	Vedel et al. (2015)	1067	22.19	22.24	Postsecondary	Denmark	NEO-FFI	Published

(Continues)

TABLE 1 (Continued)

	Study	*N*	Female %	Age	Education level	Country	Personality measure	Publication status
245	Ventura et al. (2012)	319	48.59	23	Postsecondary	US	BFI	Published
246	Vitulic and Prosen (2012) s1	203	97	19.8	Postsecondary	Slovenia	BFQ	Published
247	Vitulic and Prosen (2012) s2	80	96	19.5	Postsecondary	Slovenia	BFQ	Published
248	Vitulic and Zupancic (2013)	174	61	14.7	Elementary/middle	Slovenia	Other	Published
249	Wagerman and Funder (2007)	131	54.2		Postsecondary	US	BFI	Published
250	Waldman and Korbar (2004)	137			Postsecondary	US	Markers	Published
251	Wang et al. (2019)	148	40.54	18.51	Secondary	China	NEO-FFI	Published
252	Westphal et al. (2020) s1	12,146	51.2	14.7	Secondary	Germany	BFI	Published
253	Westphal et al. (2020) s2	6002	49.4	12.5	Elementary/middle	Germany	BFI	Published
254	Wingate and Tomes (2017)	743	68.64	18.88	Postsecondary	US	NEO-FFI	Published
255	Wintre and Sugar (2000)	419	71.36	19.2	Postsecondary	Canada	NEO-FFI	Published
256	Wolfe and Johnson (1995)	201	78.11		Postsecondary	US	BFI	Published
257	Woo et al. (2015)	478	55	19.58	Postsecondary	US	IPIP	Published
258	Woodfield et al. (2006) s1	308	0	21.11	Postsecondary	UK	NEO-FFI	Published
259	Woodfield et al. (2006) s2	323	100	21.11	Postsecondary	UK	NEO-FFI	Published
260	Xia et al. (2009)	42	46.9		Postsecondary	US	IPIP	Published
261	Zach and Inglis (2019)	173	49.9	23	Postsecondary	Israel	BFI	Published
262	Zee et al. (2013)	8545	49.3	11.6	Elementary/middle	Netherlands	Other	Published
263	Zhou (2015)	249	54	11.56	Elementary/middle	China	BFQ	Published
264	Ziegler et al. (2010)	145	82	21.9	Postsecondary	Germany	NEO-PI-R	Published
265	Zupancic et al. (2016) s1	481	55	14.2	Elementary/middle	Russia	Other	Published
266	Zupancic et al. (2016) s2	310	53	13.5	Elementary/middle	Slovenia	Other	Published
267	Zyphur et al. (2008)	207			Postsecondary	US	Markers	Published

Note: "s1," "s2" … are used to denote multiple samples from the same citation.

Abbreviations: BFI, Big Five Inventory; BFQ, Big Five Questionnaire; IPIP, International Personality Item Pool; Markers, Goldberg's (1992) unipolar Markers and it's shortened versions (i.e., Mini-Markers); NEO-FFI, NEO Five-Factor Inventory; NEO-PI-R, NEO Personality Inventory – Revised.

Details omitted for double-blind review.

published journal article, unpublished dissertations/thesis, or conference paper. Nine articles did not have all or some relevant correlations reported. The corresponding authors were contacted to retrieve either the correlation table or the data from which correlations could be extracted. Three authors shared the correlation tables or their dataset (Kornienko et al., 2018; Shchebetenko, 2016; Zee et al., 2013). One author indicated that they do not have correlation results.

2.3 | Data extraction

The features extracted from each study included authors, publication year, sample size, gender (proportion female), mean age, type of sample (e.g., secondary school students), country of sample, personality measure, cognitive ability measure, performance measure, Cronbach's alphas for personality subscales and other measures, correlation coefficients, publication status, and additional notes. Percentage of female participants in each of the original studies was used to code gender. This value ranged from 0% to 100%, with a median percentage of 60%. Mean age was coded as a continuous variable and ranged from 8.1 to 39.5, with a median age of 19.2. Type of sample was recoded into education level which was later used as a moderator with three levels: elementary/middle ($k = 25$), secondary ($k = 46$), and postsecondary ($k = 160$). Personality measure was coded as a categorical variable with 7 levels: BFI, BFQ, IPIP, Markers, NEO-FFI, NEO-PI-R, and Others. Performance measure was coded as official GPA, self-reported GPA, course grade (e.g., exam score, school subject mark), and standardized test score (e.g., ACT). Both general mental ability (i.e., intelligence) and specific cognitive abilities were considered when extracting data from primary studies. Measures of cognitive ability included, but were not limited to, full-scale IQ tests, Raven's Progressive Matrices, and CogAT. Publication status was coded as a categorical moderator with two levels: published and unpublished. To identify data reporting and entry errors, z-scores for all correlations were obtained and examined for absolute z-scores larger than 2.5. Reporting errors were observed and corrected in two studies.

2.4 | Meta-analytical procedure

Meta-analytic correlations were estimated using Comprehensive Meta-Analysis version 3.0 (Borenstein et al., 2014). Effect sizes and confidence intervals were calculated by random-effects model using restricted maximum-likelihood method. The analyses were based on Fisher's z scale. The scores were then converted back to correlation coefficients, r, to be reported in the manuscript. Several studies did not report correlation coefficients. Corresponding beta coefficients were used to impute r-based effect sizes. Dependent effect sizes were handled according to Rosenthal and Rubin's (1986) approach, which uses the intercorrelations between multiple dependent outcomes to compute a more precise estimate of a pooled effect size. The contributions of individual effect sizes to mean effect sizes were weighted by the inverse sampling variance (Lipsey & Wilson, 2001). Effect sizes were interpreted based on Cohen's (1962, 1988) benchmarks for small ($r = 0.10$), medium ($r = 0.30$), and large ($r = 0.50$) effects. In addition, Bosco et al.'s (2015) recommendation of comparing effect sizes to typical relationships found within the literature was followed when interpreting effect sizes. Effect sizes were considered significant if their 95% confidence intervals did not include zero. Cohen's d values were calculated.

Given that reliabilities of measures were not perfect, and in some studies, they were reported to be moderate, the observed correlations were corrected for measurement errors. About one-fourth of the articles did not report alpha estimates for personality measures. Original validation studies were used to obtain estimates when available. For the few remaining studies, reliabilities were estimated as the average reliability for measures in the database with equivalent numbers of items per factor. Estimates of alpha for cognitive ability and academic performance measures were reported only in a few studies. Grade point average (GPA) was the most commonly reported measure of academic performance. The reliability estimate for official GPA (0.94) was obtained from Bacon and Bean (2006). The meta-analytic correlation between official GPA and self-reported GPA (0.90) from Kuncel et al.'s (2005) study was used to calculate a reliability estimate for self-reported GPA (0.86) through the attenuation correction formula. Some studies used performance measures (e.g. course grade, exam score). The same procedure was followed to derive reliability estimates for these remaining predictor-criterion-combinations. The meta-analytic correlation between official GPA and single performance measure (0.59, Richardson et al., 2012) was used to calculate the reliability estimate for single performance measure with a single component (0.37). This estimate was adjusted for studies where multiple single performance measures were aggregated by using the Spearman-Brown formula.

The variation in the true effect sizes was explored and quantified computing the total heterogeneity of the weighted mean effect sizes (Q). Heterogeneity was also assessed by calculating the proportion of the observed variance that reflects real differences in effect sizes (I^2). Higgins et al. (2003) suggested that I^2 values on the order of 25%, 50%, and 75% might be indicative of low, medium, and high levels of heterogeneity, respectively. Where high levels of heterogeneity observed, subgroup analyses were performed. More specifically, the influence of two moderators (education levels and personality measurement types) was analyzed through

TABLE 2 Main meta-analysis correlations

	k	N	r	95% CI_r	ρ	95% $CR\rho$	d	Q	I^2	Fail-safe N	Egger's intercept	k^{TF}	Duval and Tweedie's trim and fill estimates (95% CI)
O	237	267,611	0.13	[0.11, 0.15]	0.16	[0.13, 0.19]	0.33	14,744.82***	98.40	257,533***	−3.14***	51	0.23 (0.20−0.25)
C	263	411,450	0.20	[0.18, 0.22]	0.27	[0.23, 0.31]	0.56	46,148.00***	98.26	739,217***	−0.59	64	0.34 (0.30−0.37)
E	231	265,012	0.01	[−0.01, 0.02]	0.01	[−0.01, 0.03]	0.02	3131.32***	92.62	551***	0.83**	46	0.06 (0.04−0.08)
A	227	397,710	0.07	[0.05, 0.08]	0.09	[0.05, 0.13]	0.18	32,272.13***	98.07	147,058***	−2.50*	50	0.15 (0.12−0.18)
N	236	401,003	−0.02	[−0.03, 0.00]	−0.02	[−0.04, 0.01]	−0.04	10,193.09***	97.24	852***	−1.48**	0	

Notes: O, Openness; C, Conscientiousness; E, Extraversion; A, Agreeableness; *N*, Neuroticism. *k*, number of independent studies; *N*, total sample size; *r*, estimated correlation coefficient (Pearson's) corrected for sampling error only; 95% CI_r, 95% confidence intervals for estimated correlation coefficient; ρ, correlation coefficient corrected for sampling error and measurement error in the predictor and the criterion; 95% $CR\rho$, 95% confidence intervals for corrected correlation coefficients; *d*, Cohen's *d*; Q, Cochran's measure of heterogeneity; I^2, Higgins' measure of heterogeneity; k^{TF}, number of imputed studies as a part of the trim and fill procedure.

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

subgroup analysis. In addition, meta-regressions were used for non-categorical moderators (gender distribution and age) to test if these variables were significant covariates within the meta-regression model. Egger's test for funnel plot asymmetry (Egger et al., 1997) and Rosenthal's (1979) *Fail-safe* N were used to explore publication bias.

The predictive validity of the Big Five personality traits for academic performance above and beyond cognitive ability is examined through a correlation matrix of present and previous meta-analytic correlations. This correlation matrix is used to perform a hierarchical regression model where cognitive ability is entered in Step 1 and the Big Five personality traits in Step 2. IBM SPSS 24.0 (2017) was used for the regression analysis. The harmonic mean of the meta-analytic samples is calculated and used in the analysis. Finally, relative importance indices were calculated by relative weight analysis as a supplement to the regression using the R code provided by Toninandel and LeBreton (2011).

3 | RESULTS

3.1 | Study characteristics

The current review included 228 unique studies, 206 of which were journal articles or published conference proceedings, and 22 unpublished doctoral dissertations or master's theses. One-hundred-twenty-three studies (55%) were published between 2011 and 2020. The number of studies per year has increased even further in the last 5 years. This may reflect the increasing popularity of the Big Five as well as the expanding interest in science, and a large rise in the number of available scientific journals. More studies (69%) were conducted with postsecondary students than elementary/middle and high school students. Study samples represent a variety of demographics, backgrounds, and academic contexts. Studies represented 39 different countries. The majority of them were from Europe (48%) and North America (40%). Analyses involved a total of 267 independent samples (N = 413,074). The majority of observed samples sizes (k = 169, 63%) were between 101 and 500. Twelve samples consisted of more than 5000 subjects.

3.2 | Meta-analytic correlations

Table 2 presents detailed meta-analytic results for Big Five personality traits, cognitive ability, and academic performance. Overall, the average uncorrected correlation between personality traits and academic performance was 0.08. The mean meta-analytic correlations corrected for measurement error variance in predictor and criterion for the Big Five domains were 0.16 (openness), 0.27 (conscientiousness), 0.01

(extraversion), 0.09 (agreeableness), and −0.02 (neuroticism). Thus, conscientiousness was the strongest correlate of academic performance followed by openness. Correlations for agreeableness, extraversion, and neuroticism were weak. The 95% confidence intervals of extraversion and neuroticism included zero, suggesting that their correlations with performance were not statistically significant. Tests of the homogeneity of the effect sizes using Q statistic (Hedges & Olkin, 1985) were conducted. For each personality trait, the Q value was statistically significant, suggesting true differences in effect sizes across samples. In addition, the very large I^2 heterogeneity indexes of an average 97.63% indicated that an overwhelming amount of observed variation between samples was due to systematic between-samples variability. As such, subgroup analyses and meta-regression were conducted to analyze potential moderators and identify sources of heterogeneity.

3.3 | Moderating effects of education levels

The moderating effect of education levels was examined using subgroup analysis for each personality trait. Two studies that included samples from multiple education levels were excluded from the analysis (Mammadov et al., 2018; Song et al., 2020). Table 3 gives moderation results for personality-performance correlations by education level. Results suggested a significant moderating effect of education level for openness, extraversion, and agreeableness. A decline in the strength of corrected correlations of academic performance with each of these traits was observed. The relationship of academic performance with openness at the elementary/middle school level demonstrated a large effect size ($d = 0.87$). Correlations decreased progressively with education level, yielding moderate ($d = 0.45$) and small ($d = 0.20$) effect sizes at the secondary and postsecondary education levels, respectively. A decline in the magnitudes of correlations and corresponding effect sizes in extraversion and agreeableness was observed only from elementary/middle school level to secondary school level. Correlations of academic performance with conscientiousness and neuroticism were similar across education levels. No moderation by education level was observed. Corrected correlations of conscientiousness had moderate effect sizes. The effect of neuroticism was not significant at any education level.

3.4 | Moderating effects of personality measurement types

A series of subgroup analysis was performed to examine the moderating effect of personality measurement types (see Table 4). There was a good degree of consistency among the measures. The average correlation each measure had with the other five measures were 0.88 (BFI), 0.61 (BFQ), 0.82 (IPIP), 0.78 (Mini-Markers), 0.87 (NEO-FFI), 0.89 (NEO-PI-R), and 0.86 (Others). The BFQ was remarkably less consistent. It had significantly stronger average correlations for openness ($\rho = 0.45$) and extraversion ($\rho = 0.13$) than all other measures. The 95% credibility interval for the Mini-Markers Openness/Intellect scale included zero. The most consistent meta-analytic correlations across scales were observed in conscientiousness. The effect sizes ranged from 0.37 to 0.65, with a median effect size of 0.58. Another notable measure-specific result was that the BFI exhibited wide associated heterogeneity across studies, especially for conscientiousness, agreeableness, and neuroticism.

3.5 | Moderating effects of geographical regions of primary studies

Another series of subgroup analysis was performed to compare results by country clusters or regions of primary studies included in the present meta-analysis. Studies with Asian samples tended to yield substantially larger correlation coefficients across all personality traits compared with studies from other regions. For conscientiousness, the average coefficient of studies with Asian samples was $\rho = 0.35$, the highest coefficient along with the Middle Eastern samples. Studies with Asian and Middle Eastern samples also had stronger average correlations for agreeableness ($\rho = 0.23$ and $\rho = 0.17$, respectively) compared with other regions. A similar pattern was observed for extraversion. Asian studies demonstrated moderate and Middle Eastern studies demonstrated small effect sizes ($d = 0.32$ and $d = 0.14$, respectively). The 95% credibility intervals of extraversion for all other regions included zero. Table 5 presents detailed results for each subgroup.

3.6 | Meta-regression for gender composition and age

Table 6 presents the results of moderator analyses using meta-regression for gender composition and age. Percentage of females served as a continuous variable when testing moderating effects of gender distribution. Studies included in the meta-analysis tended to have more females than males. The median percentage of females was 60.1%. Only 24.1% of study samples had more males than females. The two-tailed p values corresponding to Z for openness and extraversion were $p < 0.001$ and $p < 0.05$, respectively, suggesting that the slopes were probably not zero, and that openness ($B = -0.003$, CI [−0.004, 0.001], $Z = -3.49$, $p < 0.001$) and extraversion ($B = -0.001$, CI [−0.001, −0.000], $Z = -2.36$,

TABLE 3 Moderation of personality–academic performance correlations by education level

Educational level	*k*	*N*	*ρ*	95%	*d*	*B*	SE	R^2	*Z*-value	*Q*
Openness										
Elementary/ middle (reference)	24	29,342	0.40	0.32, 0.48	0.87	0.42	0.04	0.24	11.18***	
Secondary	54	73,229	0.22	0.17, 0.27	0.45	−0.20	0.05		−4.40***	68.37***
Postsecondary	158	164,162	0.10	0.06, 0.15	0.20	−0.32	0.04		−7.86***	
Conscientiousness										
Elementary/ middle (reference)	31	166,436	0.31	0.24, 0.38	0.65	0.32	0.04	0.00	8.88	
Secondary	55	73,895	0.27	0.21, 0.32	0.56	−0.05	0.05		−1.02	2.13
Postsecondary	175	169,411	0.26	0.23, 0.29	0.54	−0.05	0.04		−1.46	
Extraversion										
Elementary/ middle (reference)	23	29,080	0.15	0.11, 0.19	0.30	0.16	0.03	0.11	4.90***	
Secondary	51	72,391	0.01	−0.03, 0.04	0.02	−0.14	0.04		−3.91***	23.13***
Postsecondary	156	162,663	−0.01	−0.03, 0.01	−0.02	−0.16	0.03		−4.79***	
Agreeableness										
Elementary/ middle (reference)	26	163,733	0.18	0.11, 0.24	0.37	0.18	0.04	0.03	5.16***	
Secondary	48	70,070	0.08	0.03, 0.13	0.16	−0.10	0.04		−2.21*	7.39*
Postsecondary	152	163,029	0.08	0.05, 0.11	0.16	−0.10	0.04		2.69**	
Neuroticism										
Elementary/ middle (reference)	27	164,610	−0.01	−0.06, 0.04	−0.02	−0.01	0.03	0.00	−0.33	
Secondary	50	71,423	−0.01	−0.04, 0.03	−0.02	0.01	0.04		0.18	0.59
Postsecondary	158	164,092	−0.02	−0.05, −0.00	−0.04	−0.01	0.03		−0.38	

Notes: k, number of independent studies; *N*, total sample size; *ρ*, correlation coefficient corrected for sampling error and measurement error in the predictor and the criterion; 95%, 95% confidence intervals; *d*, Cohen's *d*; *B*, regression coefficient; SE, standard error; R^2, ratio of explained variance to total variance; *Z*-value, *z*-test result computed to test the significance of the slope; *Q*, Cochran's measure of heterogeneity.

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

$p < 0.05$) were less effective predictors of academic performance for samples with larger proportions of females. The higher the percentage of females, the lower the correlations. The effect of age, too, was significant for openness and extraversion. Consistent with the subgroup analyses findings, the relationships of performance with openness ($B = -0.014$, CI [−0.019, −0.009], $Z = -5.29$, $p < 0.001$) and extraversion ($B = -0.004$, CI [−0.008, −0.000], $Z = -2.03$, $p < 0.05$) became weaker as age increased. The associations with other personality traits did not appear to be affected by gender distribution and age.

3.7 | Publication bias

A publication bias analysis was conducted to examine whether studies with statistically significant correlations were more likely to be published than non-significant results. The analysis of weighted random effects model in which the publication status was included as a dichotomous moderator suggested a minimal concern. Publication status did not significantly moderate the effect of personality traits on academic performance. The effect sizes were larger for published than unpublished studies only for openness and

TABLE 4 Subgroup analysis of personality–academic performance relationships by personality measurement types

Measure type	*k*	*N*	*ρ*	95%	*d*	*Q*	I^2
Openness							
BFI	46	67,792	0.10	0.04, 0.16	0.20	555.83	91.90
BFQ	20	6360	0.45	0.37, 0.52	1.01	576.67	96.71
IPIP	27	7612	0.10	0.02, 0.19	0.20	186.29	86.04
Markers	15	3326	0.06	−0.06, 0.17	0.12	81.43	82.81
NEO-FFI	52	27,273	0.13	0.07, 0.19	0.26	341.14	85.05
NEO-PI-R	35	8931	0.13	0.05, 0.20	0.26	158.78	78.59
Others	42	146,267	0.22	0.16, 0.28	0.45	8408.53	99.51
Conscientiousness							
BFI	58	207,409	0.26	0.20, 0.31	0.54	11,729.44	99.51
BFQ	20	6360	0.30	0.20, 0.40	0.63	449.22	95.77
IPIP	32	8909	0.31	0.23, 0.39	0.65	271.12	88.56
Markers	16	3629	0.18	0.06, 0.29	0.37	43.65	65.64
NEO-FFI	56	27,954	0.28	0.22, 0.34	0.58	355.37	84.52
NEO-PI-R	38	9974	0.28	0.21, 0.35	0.58	296.33	87.51
Others	43	147,408	0.25	0.18, 0.31	0.52	6077.91	99.29
Extraversion							
BFI	46	66,564	0.00	−0.03, 0.04	0.01	628.45	92.84
BFQ	17	5522	0.13	0.07, 0.19	0.26	255.71	93.74
IPIP	26	7338	−0.03	−0.08, 0.02	−0.06	127.42	80.38
Markers	15	3326	−0.02	−0.09, 0.05	−0.04	34.65	59.60
NEO-FFI	53	27,411	−0.02	−0.05, 0.01	−0.04	337.89	84.61
NEO-PI-R	33	8220	−0.01	−0.05. 0.04	−0.02	156.76	79.59
Others	41	146,824	−0.06	0.03, 0.10	−0.12	1303.31	96.85
Agreeableness							
BFI	46	200,525	0.05	−0.02, 0.12	0.10	14,720.88	99.69
BFQ	16	4554	0.15	0.03, 0.27	0.30	238.29	93.71
IPIP	26	7338	0.17	0.08, 0.27	0.35	335.15	92.54
Markers	15	3326	−0.03	−0.15, 0.10	−0.06	74.11	81.11
NEO-FFI	50	26,891	0.12	0.05, 0.18	0.24	434.79	88.73
NEO-PI-R	33	8220	0.09	0.00, 0.17	0.18	166.89	80.83
Others	41	147,049	0.06	−0.02, 0.13	0.12	2841.23	98.56
Neuroticism							
BFI	49	202,400	0.00	−0.04, 0.04	0.01	2509.86	98.09
BFQ	16	4554	−0.01	−0.08, 0.06	−0.02	52.51	71.44
IPIP	28	7959	−0.02	−0.07, 0.04	−0.04	495.94	94.56
Markers	16	3629	0.01	−0.06, 0.08	0.02	28.72	47.77
NEO-FFI	52	27,161	−0.07	−0.11, −0.03	−0.14	316.20	83.87
NEO-PI-R	34	8594	0.01	−0.04, 0.06	0.02	177.21	81.38
Others	41	146,895	−0.01	−0.05, 0.03	−0.02	1506.21	87.28

Note: BFI, Big Five Inventory; BFQ, Big Five Questionnaire; IPIP, International Personality Item Pool; Markers, Goldberg's (1992) unipolar Markers and it's shortened versions (i.e., Mini-Markers); NEO-FFI, NEO Five-Factor Inventory; NEO-PI-R, NEO Personality Inventory – Revised. *k*, number of independent studies; *N*, total sample size; *ρ*, correlation coefficient corrected for sampling error and measurement error in the predictor and the criterion; 95%, 95% confidence intervals; *d*, Cohen's *d*; Q, Cochran's measure of heterogeneity; I^2, Higgins' measure of heterogeneity.

TABLE 5 Subgroup analysis of personality–academic performance relationships by regions of studies

Measure type	*k*	*N*	*ρ*	95%	*d*	*Q*	I^2
Openness							
Asia	16	5925	0.29	0.14, 0.43	0.61	500.57	97.00
Australia	7	5222	0.17	0.07, 0.26	0.35	57.27	89.52
E. Euro/Rus	24	11,921	0.18	0.10, 0.26	0.37	378.41	93.92
M. East	10	2386	0.15	0.02, 0.28	0.30	85.29	89.46
N. America	80	142,179	0.14	0.07, 0.20	0.28	8369.52	99.06
W. Euro	98	99,661	0.17	0.13, 0.21	0.35	3333.13	97.09
Conscientiousness							
Asia	16	5925	0.35	0.17, 0.50	0.75	786.53	98.09
Australia	9	6386	0.24	0.18, 0.29	0.50	34.18	76.59
E. Euro/Rus	26	12,469	0.30	0.24, 0.36	0.63	292.93	91.47
M. East	10	2386	0.35	0.25, 0.44	0.75	57.66	84.40
N. America	96	147,660	0.23	0.18, 0.27	0.47	5242.35	98.19
W. Euro	104	236,307	0.28	0.24, 0.33	0.58	13,913.74	99.26
Extraversion							
Asia	16	5872	0.16	0.01, 0.30	0.32	482.59	96.89
Australia	7	5222	0.06	−0.02, 0.13	0.12	33.99	82.35
E. Euro/Rus	25	12,095	−0.00	−0.06, 0.05	−0.01	170.53	85.93
M. East	11	3729	0.07	0.02, 0.11	0.14	14.81	32.45
N. America	77	140,177	−0.01	−0.03, 0.01	−0.02	608.50	87.51
W. Euro	93	88,624	−0.01	−0.04. 0.02	−0.02	1158.51	92.06
Agreeableness							
Asia	15	5459	0.23	0.09, 0.35	0.47	339.39	95.88
Australia	7	5222	0.12	0.08, 0.17	0.24	12.98	53.79
E. Euro/Rus	25	11,304	0.07	0.01, 0.13	0.14	242.92	90.12
M. East	11	3729	0.17	0.08, 0.26	0.35	65.67	84.77
N. America	74	139,752	0.09	0.05, 0.12	0.18	2046.17	96.43
W. Euro	93	221,911	0.07	0.01, 0.13	0.14	17,103.11	99.46
Neuroticism							
Asia	16	5623	−0.19	−0.35, −0.02	−0.39	619.80	97.58
Australia	8	5720	−0.02	−0.07, 0.03	−0.04	18.44	62.03
E. Euro/Rus	26	11,678	0.03	−0.04, 0.09	0.06	279.15	91.04
M. East	11	3729	−0.02	−0.09, 0.04	−0.04	31.61	68.37
N. America	78	140,781	0.00	−0.03, 0.03	0.01	1442.90	94.66
W. Euro	95	223,139	−0.01	−0.05, 0.02	−0.02	4479.28	97.90

Note: E. Euro/Rus, Eastern Europe and Russia; M. East, Middle East; N. America, North America; W. Euro, Western Europe; *k*, number of independent studies; *N*, total sample size; *ρ*, correlation coefficient corrected for sampling error and measurement error in the predictor and the criterion; 95%, 95% confidence intervals; *d*, Cohen's *d*; Q, Cochran's measure of heterogeneity; I^2, Higgins' measure of heterogeneity.

conscientiousness, but the differences were small ($\Delta\rho = 0.03$ and 0.07, for openness and conscientiousness, respectively). The confidence intervals of unpublished and published studies overlapped, suggesting no statistically significant differences between the two categories.

Another way used to assess publication bias was the Egger's regression intercept test. The Egger's regression method yielded intercepts (β_0) ranging from −0.59 for conscientiousness to 0.83 for extraversion. The 95% confidence interval for conscientiousness included zero [−2.62–1.44], suggesting no publication bias for this personality trait, $t(262) = 0.57$, $p > 0.05$. For all other personality traits, the confidence intervals did not include zero and *t* values were significant, suggesting substantial asymmetry in the Funnel plots, which could have been caused by publication bias (see Figure 2). Duval and Tweedie's (2000) trim and fill procedure

TABLE 6 Meta-regressions testing moderating effects of gender distribution and age on personality traits/academic performance link

Moderator	*k*	*B*	SE	95% CI Lower	95% CI Upper	*Z*
Moderating effect of gender composition						
Openness (intercept)	216	0.31	0.05	0.23	0.40	6.90***
Proportion female		−0.003	0.001	−0.004	0.001	−3.49***
Conscientiousness (intercept)	236	0.23	0.04	0.14	0.31	5.42***
Proportion female		0.001	0.001	−0.001	0.002	1.20
Extraversion (intercept)	210	0.09	0.04	0.02	0.17	2.60**
Proportion female		−0.001	0.001	−0.001	−0.000	−2.36*
Agreeableness (intercept)	203	0.09	0.04	0.02	0.17	2.19*
Proportion female		−0.000	0.001	−0.002	0.001	−0.31
Neuroticism (intercept)	211	−0.07	0.04	−0.15	0.01	−1.82
Proportion female		0.001	0.001	−0.000	0.002	1.40
Moderating effect of age						
Openness (intercept)	195	0.43	0.05	0.33	0.53	8.38***
Age		−0.014	0.003	−0.019	−0.009	−5.29***
Conscientiousness (intercept)	209	0.31	0.05	0.22	0.41	6.34***
Age		−0.002	0.003	−0.007	0.003	−0.70
Extraversion (intercept)	191	0.10	0.04	0.015	0.176	2.34*
Age		−0.004	0.002	−0.008	−0.000	−2.03*
Agreeableness (intercept)	185	0.09	0.04	0.01	0.17	2.20*
Age		−0.001	0.002	−0.005	0.003	−0.35
Neuroticism (intercept)	192	−0.03	0.04	−0.10	0.04	−0.81
Age		0.001	0.002	−0.003	0.004	0.29

Note: k, number of independent studies; *B*, regression coefficient; SE, standard error; 95% CI, 95% confidence intervals; *Z*, *z*-test result computed to test the significance of the slope.

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

was carried out to calculate the best estimate of the unbiased effect size. Table 2 gives the number of imputed studies and adjusted estimates along with the 95% confidence intervals.

3.8 | Incremental prediction of the big five over and above cognitive ability

In addition to the moderation analyses, the relationship between cognitive ability and academic performance from the studies included in this meta-analysis based on the current search criteria was examined. A total of 67 studies with 112 effect sizes and 55,260 participants were included in the analysis. Cognitive ability showed a moderate-to-large association with academic performance ($\rho = 0.42$, CI [0.37, 0.46], $p < 0.001$, $d = 0.93$, $I^2 = 97.75\%$). This value of $\rho = 0.42$ was used in further analysis to assess incremental prediction of the Big Five personality traits over and above cognitive ability. The meta-analytic correlation matrix was created by deriving the estimates from the present and previous meta-analyses (Judge et al., 2007; van der Linden et al., 2010). The matrix then was used to perform a multiple regression analysis predicting academic performance from cognitive ability and personality traits. Table 7 presents meta-analytic correlation

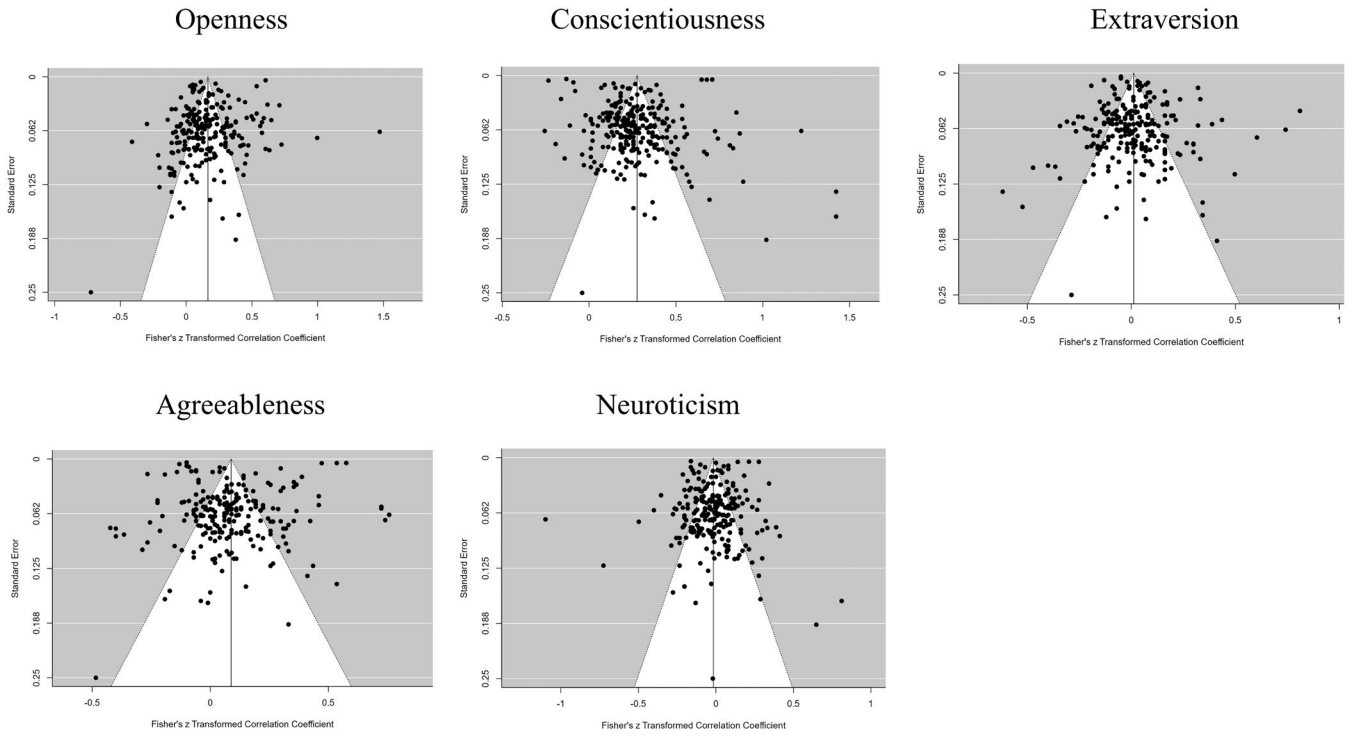

FIGURE 2 Funnel plots of the standard error and Fisher's *z* transformed correlation coefficients between personality traits and academic performance

TABLE 7 Meta-analytic correlation matrix of the big five, cognitive ability, and academic performance

	1	2	3	4	5	6	7
1. Academic performance	1						
2. Cognitive ability	0.42[a]	1					
3. Openness	0.16[a]	0.22[b]	1				
4. Conscieniousness	0.27[a]	−0.04[b]	0.24[c]	1			
5. Extraversion	0.01[a]	0.02[b]	0.39[c]	0.27[c]	1		
6. Agreeableness	0.09[a]	0[b]	0.30[c]	0.46[c]	0.33[c]	1	
7. Neuroticism	−0.02[a]	−0.09[b]	−0.18[c]	−0.36[c]	−0.37[c]	−0.34[c]	1

[a]The present meta-analysis.

[b]Judge et al. (2007).

[c]van der Linden et al. (2010).

matrix and Table 8 gives regressions results. No collinearity was detected. Tolerance values were acceptable, all above 0.7 and greater than the threshold of 0.1. Cognitive ability and personality predicted 27.8% of the variance in academic performance. Cognitive ability was the most important predictor with a relative importance of 63.59%. Conscientiousness was the second most important predictor (RW% = 27.93%). Relative importance was small for openness (RW% = 3.94%) and negligible for other personality traits. Of the Big Five, only conscientiousness and neuroticism showed significant incremental validity in predicting performance. Partial correlations of personality traits with academic performance were 0.35 for conscientiousness, 0.13 for neuroticism, −0.05 for extraversion, 0.03 for openness, and −0.02 for agreeableness.

4 | DISCUSSION

The present meta-analysis provides a comprehensive assessment of the links between self-reported personality traits and performance, using the Big Five framework of personality. The large body of research that has emerged in the last three decades is synthesized by incorporating all Big Five traits, a broad range of performance measures, and all stages of

TABLE 8 Multiple regression predicting academic performance from cognitive ability (Step 1) and big five personality traits (Step 2) based on the correlation matrix presented in Table 7

	B	95% CI	ΔR^2	RW	RW%
Step 1			0.176^{**}		
Cognitive ability	0.42^{**}	0.41, 0.43		0.177	63.59%
Step 2			0.102^{**}		
Openness	0.03^{**}	0.02, 0.04		0.011	3.94%
Conscientiousness	0.35^{**}	0.34, 0.36		0.078	27.93%
Extraversion	-0.05^{**}	−0.06, 0.04		0.002	0.81%
Agreeableness	-0.02^{**}	−0.03, −0.01		0.005	1.84%
Neuroticism	0.13^{**}	0.11, 0.14		0.005	1.88%
Total R^2			0.278^{**}		

Note: $N_{\text{harmonic}} = 34{,}163$; *B*, regression coefficient; 95% CI, 95% confidence intervals; RW, relative weight.
$^{**}p < 0.01$.

education from elementary school through university. The present meta-analysis provides more reliable and valid estimates compared with previous similar meta-analyses, as it includes substantially more studies. In addition to summarizing relationships between the Big Five and academic performance from a total of 268 independent samples ($N = 413{,}267$), this study tested the contribution of several important moderators to heterogeneity. The present meta-analysis also provides the robust assessment of incremental validity of the Big Five for academic performance above and beyond cognitive ability.

Results demonstrate that three of the Big Five personality traits, conscientiousness, openness, and agreeableness, show significant associations with academic performance. As expected, conscientiousness was clearly the best personality predictor of performance ($\rho = 0.27$). This estimate was slightly larger than that the corrected mean effect sizes reported in recent meta-analyses, Poropat (2009; $\rho = 0.22$, $N = 70{,}926$), McAbee and Oswald (2013; $\rho = 0.26$, $N = 26{,}382$), and Vedel (2014; $\rho = 0.26$, $N = 17{,}717$). The magnitudes of the effect sizes of conscientiousness were statistically significant across education levels. No moderation by education level was observed. Conscientiousness was also the second most important variable after cognitive ability, accounting for 28% of the explained variance in academic performance. The relative importance of conscientiousness was about four times greater than the total of all other personality traits. Of the personality measures, the Markers yielded the lowest effect size for conscientiousness ($\rho = 0.18$), with a very large confidence interval [0.06, 0.29]. As noted earlier, the Markers conscientiousness focuses on organization and orderliness and has less items measuring the performance-striving facet compared with the other instruments. Observing a weaker correlation for the studies using this instrument was expected and is consistent with McAbee and Oswald's (2013) meta-analysis.

Personality traits are likely to be distal predictors of academic outcomes. Therefore, it is important to understand the mechanisms by which conscientiousness exerts its effect on performance. Conscientiousness is about the propensity to be organized, self-controlled, perseverant, and effective at carrying out tasks (De Feyter et al., 2012; McCrae & John, 1992). These characteristics and skills are important for students to be successful across all academic domains and educational stages. Previous studies have reported a number of proximal constructs, such as performance motivation (Richardson & Abraham, 2009), academic motivation (De Feyter et al., 2012; Mammadov et al., in press), academic self-efficacy (Conrad & Patry, 2012), self-efficacy for self-regulated learning (Mammadov et al., 2018), perceived academic ability and academic effort (Noftle & Robins, 2007), serving as mediators transmitting the effect of conscientiousness to performance. A detailed examination of these mediational processes could help better elucidate the predictive role of conscientiousness.

Openness demonstrated a weak and positive overall association with academic performance ($\rho = 0.16$). This mean effect size estimate was larger than those reported in the previous meta-analyses (Gatzka & Hell, 2018; Poropat, 2009; Trapmann et al., 2007). Age and education level were significant moderators of the meta-analytic effect of openness. The strength of the relationship of openness with academic performance weakens as student age increases. Subgroup analysis with education levels suggested that openness appeared to be a significantly stronger predictor of academic performance at the elementary/middle school level ($\rho = 0.40$), than secondary ($\rho = 0.22$) and postsecondary levels ($\rho = 0.10$). Poropat (2009) reported a similar pattern of decline by education level, but all estimates were smaller than the estimates found in the present meta-analysis. One explanation of the presence of the stronger relationship at elementary/middle school level compared with the subsequent levels is that openness in younger students is more narrowly defined and includes only the facets closely linked to performance (Shiner, 2006). Another explanation is the possible predominance of openness as a specific feature in young children (Neuenschwander et al., 2013). One notable finding for openness-performance relationship comes from the regression analysis. Openness

accounted for only 4% of the explained variance in academic performance and had much weaker relative weight than conscientiousness. Other personality traits demonstrated little or no explanatory power over cognitive ability. Note that the regression model used a correlation matrix composed of the current and previous meta-analytic correlations. Therefore, the partial correlations found in the regression analysis should not be directly comparable with the mean effect size estimates.

Agreeableness, too, emerged as a significant but weak predictor of academic performance ($\rho = 0.09$). Education level moderated the relationship. A decline of the mean effect size was observed from elementary/middle school level to secondary school level. Perhaps friendly and sympathetic behaviors of young agreeable students facilitate their relationships with peers and teachers, and therefore support their overall learning experiences. Another reason why the association of agreeableness with performance was relatively high for younger students may be that collaborative group activities are an integral part of assessment in elementary educational contexts. This seems to be the plausible explanation because extraversion also yielded a significant effect at elementary/middle school level ($\rho = 0.15$), but the significance disappeared at subsequent levels. Like agreeableness, extraversion is an interpersonal personality trait and plays an important role in managing social relationships and possible interpersonal conflicts within group activities (Watson & Clark, 1997). These skills are likely to be closely reflected in young students' end-of-year grades.

Another explanation of the positive effect of extraversion at elementary/middle school level is related to a complex nature of extraversion. On the one hand, extraversion is characterized by high energy levels that may lead students to have positive attitudes toward learning (Authors, in press; De Raad & Schouwenburg, 1996). On the other hand, it may facilitate socializing behaviors instead of doing schoolwork and preparing for exams. Because social-emotional growth and development of younger students are more carefully supported at earlier school years, they are likely to be provided with enough time for social activities. In addition, curriculum, assessment, and other school-related activities are designed to be more interesting for all students at elementary/middle school level than secondary and postsecondary levels. To that end, the aspect of extraversion that may be negatively related to performance-related outcomes are less active in earlier educational contexts.

Neuroticism or emotional stability does not seem to be an important determinant of academic performance. The overall corrected mean effect size is −0.02, with the confidence interval including zero. Its relative importance as a predictor explaining variance in performance was negligible (2%). One notable finding from subgroup analyses was that the NEO-FFI neuroticism had a negative effect on academic performance ($\rho = -0.07$). The 95% confidence interval [−0.11, −0.03] did not include zero, suggesting that it was statistically significant. All other personality measures yielded consistent nonsignificant effect sizes. Education level was not a significant moderator. Poropat (2009), in his meta-analysis, compared the mean effect for education levels and reported a significant association of neuroticism with performance at the primary level (i.e., elementary/middle; $\rho = -0.20$). This mean effect size estimation was calculated based on a limited number of available samples at that time ($k = 8$). Given that the present meta-analytic sample is much larger and includes all relevant original studies from previous meta-analyses, our summary effect seems to be more accurate.

Asian samples consistently yielded stronger average correlations between personality traits and academic performance than studies from other regions. This was an interesting finding that needs further investigation. Because there were 16 Asian samples, which comprised only 1.5% of the overall meta-analytic sample, it was difficult to discern the real causes behind this observed pattern of differences. The vast majority of studies were carried out with North American and Western European samples. What we can say for sure is that there is the need for more research on personality-academic performance relationships with samples from non-WEIRD cultures. Cross-cultural studies with similar methodologies across countries could provide valuable insights on how cultural factors may play a role in the ways academic performance reflects personality.

5 | CONCLUSION

Student learning and performance not only depend on cognitive ability, but also on their personality (Neuenschwander et al., 2013). The present meta-analysis reaffirms the critical role of personality traits in explaining academic performance through the most comprehensive assessment yet of these relationships. Results suggest that conscientiousness is the robust predictor of student performance and should be at the forefront of intervention approaches. This personality trait accounts for performance above and beyond cognitive ability. Openness, despite its weak overall relative importance, is also an important determinant of student performance, especially at elementary/middle school level. Two broad applications might be considered. First, personality measures might be used as a supplemental screening tool, along with ability and aptitude scales, in identifying students at risk for underperformance and school failure. Possible distortion issues should be carefully discussed when making decisions about this application. Several meta-analyses have suggested that individuals taking personality measures may be motivated to score high on particular traits and distort responses on those scales to "fake

high" (Birkeland et al., 2006; Viswesvaran & Ones, 1999). Equally useful and impartial alternatives to self-report measures should be considered to address this potential problem. Second, educators and counselors should work hand in hand to nurture the positive qualities of personality traits through widely recommended educational best practices. For example, students could become more open to new experiences of learning by being strategically encouraged to think beyond the confines of curricular topics, make connections between classroom curriculum and real life experiences, and integrate focuses and creative ideas on a broad exposure. Students should also be taught self-regulatory skills, self-discipline, and performance-striving through modeling and other instructional approaches (Peeters et al., 2014). It should be noted that personality is more malleable in childhood and early adolescence than in adulthood (Roberts & DelVecchio, 2000). It may be more appropriate to think of reinforcing productive personality as an intervention that is more effective at earlier education years.

6 | LIMITATIONS AND FUTURE RESEARCH

As with most other meta-analyses, this study is not without limitations. At least four of them, which may provide promising opportunities for further research, are worth mentioning. First, there is some evidence for publication bias as assessed by Egger's test. The computed effect sizes are likely to be overestimated. Trim and fill analysis was performed to calculate the best unbiased effect size estimates. These estimates, too, should be read cautiously, because the observed evidence for publication bias could partially be attributable to extreme heterogeneity. Second, multiple measures of academic performance were used in the original studies. Cronbach's alphas were only reported in a few of them. For the vast remaining majority, the reliability estimates were either obtained from other sources or calculated for use in the present meta-analysis. The calculated reliability estimates for single and multiple performance measures were as low as $\alpha = 0.37$ for several studies. This problem made it difficult to determine the true effect sizes. We also do not know whether exams and courses that performance measures were collected for promoted surface-level learning or a deeper understanding of the content. Results and their interpretations should be viewed with caution. Third, effect sizes reported in this meta-analysis remain uncorrected for range restrictions which may result in underestimation of the strength of correlations. Future studies should consider applying corrections for range restrictions. Fourth, calculating and summarizing effect sizes at the facet level of the Big Five may help better understand the personality–performance relationships. Narrowly defined facets are likely to provide additional explanatory power in predicting performance (Soto & John, 2017). Although included studies for that purpose will be limited only to longer personality measures that make facet-level distinctions (e.g., the NEO PI-R), looking at specific construct components is valuable and future studies should consider it.

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CONFLICT OF INTEREST

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

AUTHOR CONTRIBUTIONS

Sakhavat Mammadov is the sole author of this study and was responsible for study design, conception, statistical data analyses, and interpretation.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in Open Science Framework at https://osf.io/tkwdu/ [Identifier: DOI 10.17605/OSF.IO/TKWDU].

ETHICS

This study is a meta-analytic review of findings from previous studies and did not involve human subjects. No ethical approval was needed from an Institutional Review Board (IRB).

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the Supporting Information section.

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