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A Meta-Analysis of the Five-Factor Model of Personality and Academic Performance

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Abstract

This article reports a meta-analysis of personality-academic performance relationships, based on the Five-Factor Model (FFM), with cumulative sample sizes ranging to over 70,000. Most analyzed studies came from the tertiary level of education, but there were similar aggregate samples from secondary and tertiary education. There was a comparatively smaller sample derived from studies at primary level. Academic performance was found to significantly correlate with Agreeableness, Conscientiousness and Openness to Experience. Where tested, correlations between Conscientiousness and academic performance were largely independent of intelligence. When secondary academic performance was controlled for, Conscientiousness added as much to the prediction of tertiary academic performance as did intelligence. Strong evidence was found for moderators of correlations. Academic level (primary, secondary or tertiary), average age of participant, and the interaction between academic level and age significantly moderated correlations with academic performance. Possible explanations for these moderator effects are discussed and recommendations for future research are provided.

Key-words: Personality; Intelligence; Academic Performance; Meta-Analysis; Moderation

A Meta-Analysis of the Five-Factor Model of Personality and Academic Performance

Research on personality and its relationships to important personal, social and economic constructs is as vibrant and influential as ever (Funder, 2001) and has been credited with prompting many of the major advances in fields such as organizational behavior (Hough, 2001). Much of this contribution can be linked directly to theoretical and statistical reviews of the role of personality, such as the pivotal meta-analyses of correlations between personality and work performance (Barrick & Mount, 1991; Hough, Eaton, Dunnette, Kamp, & McCloy, 1990). Such integrations of research have allowed researchers to assess the major features of these relationships, providing guidance for future studies. It is therefore surprising that, to date, there has been no comparable review of the relationship between personality and academic performance. This article reports on an attempt to provide just such an exhaustive statistical review.

A brief history of research on personality and academic performance

One of the earliest applications of trait-based personality assessment was the prediction of academic performance. Webb (1915) proposed the existence of a construct he labelled *w*, representing a *will* factor, which Spearman (1927) later argued sat alongside the general intelligence factor *g* as a contributor to academic ability. Consistent with this, research by Webb and others (e.g., Flemming, 1932) found that personality measures were correlated with academic performance. Unfortunately, early research was beset by inconsistent research findings and methodological problems. In one of the earliest reviews of the field, Harris (1940) expressed the view that personality contributed to academic performance, but acknowledged that this was unsupported by evidence because research up to that point was marred by inconsistent and flawed methodologies. Later, Stein (1963) emphasized the difficulty of making sense of research

based on diverse theories and measures, while Margrain (1978) noted much creativity in methodology, but findings that showed no clear trends. The next major review of the field (De Raad, & Schouwenburg, 1996) still highlighted the scattered nature of this research and its lack of an overarching framework or paradigm, while Farsides and Woodfield (2003) concluded that findings had been “erratic” (p. 1229). In brief, reviews of research on the relationship between personality and academic performance have generally presented equivocal conclusions, largely due to the use of variable research methodologies and theoretical bases.

Just as with academic performance, early research on links between personality and work performance found variable results, leading to the conclusion that general dimensions of personality were largely unrelated to work performance (Guion & Gottier, 1965). Two methodological advances helped reverse that conclusion: the advent of meta-analytical techniques for effectively combining results from previous research (e.g., Hunter, Schmidt, & Jackson, 1982) and the growing acceptance of broad factorial models of personality, which provided a framework for comparing personality studies. In particular, the Five-Factor Model (FFM) of personality, which is made up of the dimensions of Agreeableness (reflecting likeability and friendliness), Conscientiousness (dependability and will-to-achieve), Emotional Stability (adjustment versus anxiety), Extraversion (activity and sociability), and Openness (imaginativeness, broad-mindedness and artistic sensibility), has been important in this regard. The value of the FFM is that it encompasses most of the variance in personality description in a simple set of dimensions, thus bringing order to the previous “chaotic plethora” of personality measures (Funder, 2001, p. 200). Barrick and Mount (1991) used the FFM to organize their meta-analysis, thus providing one of the first broad-ranging estimates of the relationship between personality and work performance. Since then, a series of meta-analyses, culminating in Barrick,

Mount and Judge's (2001) second-order meta-analysis, have provided a largely consistent picture — personality measures, especially Conscientiousness, are associated with a range of workplace performance criteria.

Given the long-standing interest in the relationship between personality and academic performance, it is surprising that no similarly authoritative meta-analyses have been reported. A thorough meta-analysis using the FFM framework would effectively address many of the concerns raised by earlier reviewers regarding inconsistent personality theories and scales. To date, there have been several meta-analyses of the relationship between personality and academic performance; however each of these is limited in range or suffer from methodological problems. Beginning with measurement issues, the meta-analysis reported by Hough (1992) was based on a broad set of personality measures that had within-category correlations ranging from .33 to .46 (average of .39), casting doubt on the homogeneity and hence the interpretability of these categories. Similar criticisms can be made of the meta-analysis reported by Trapmann, Hell, Hirn and Schuler (2007), which used a variety of measures of personality that had not been designed to assess the FFM (e.g., early versions of the 16PF and the California Psychological Inventory). Hough also included both grades and college attendance as measures of academic performance, but these measures are far from synonymous. For example, Farsides and Woodfield (2003) reported a correlation of $-.36$ between absenteeism and final-year percentage. In contrast, the meta-analyses reported by Poropat (2005) and O'Connor and Paunonen (2007) addressed these measurement problems by using only FFM-based measures and restricting themselves to measures of grade and grade point average (GPA). However, O'Connor and Paunonen (2007), like Poropat (2005) and Trapmann et al. (2007) restricted their meta-analyses to post-secondary

academic performance. Hough (1992) did include correlations with secondary school performance but aggregated these with correlations with post-secondary academic performance.

One of the main strengths of meta-analysis is that it allows researchers to test for the presence of moderators, rather than accepting a single, over-arching estimate. However, neither Hough (1992) nor the meta-analyses by Poropat (2005) and O'Connor and Paunonen (2007) reported estimates of homogeneity for their samples, which is the first step in looking for moderators. Trapmann et al. (2007) did look for moderators and found heterogeneity in their sample of correlations, but their search for moderators was limited by application of a restrictive significance level ($p < .00455$) and the use of the unreliable method of hierarchical sub-group analysis (Steel & Kammeyer-Mueller, 2002: moderator analysis is discussed in more detail in the Results section). A further problem is that, apart from Hough (1992), each of these meta-analyses restricted its surveys to published studies, with O'Connor and Paunonen (2007) using what they referred to as "the major papers available on the topic" (p.974). This form of sampling can lead to biased estimates due to selective publication (Rosenthal & DiMatteo, 2001). Finally, none of these meta-analyses assessed whether correlations between personality and academic performance were confounded with underlying relationships with intelligence. As one reviewer noted, there is a long-standing speculation that all positively evaluated traits, such as personality and intelligence, are associated (Thorndike, 1940) so any links between personality and academic performance may be due to this. These various flaws have limited the interpretability of earlier meta-analyses, so the current research was undertaken to provide reliable estimates based on a literature search that was relatively exhaustive, while investigating the impact of various moderators and controlling for the influence of intelligence.

Academic performance

Apart from its theoretical value, there is considerable practical value in being able to statistically predict academic performance. Among the member countries of the Organisation for Economic Cooperation and Development (OECD), an average of 6.2% of gross domestic product is spent on educational activities, while the average young person in these countries will stay in education until the age of 22 (OECD, 2007). Clearly, the academic performance of students is highly valued within these advanced economies, such that any increments in understanding of academic performance have substantial implications.

The dominant measures of academic performance are grades and especially GPA, as attested by their frequent use as criterion variables in research (Kuncel, Crede, & Thomas, 2005). Despite their common use, the reliability and validity of grades and GPA have been questioned because of factors such as grade inflation, which is the tendency to provide higher grades for the same substantive performance at different levels of study, or at different periods in time (Johnson, 1997). Grade inflation can be problematic when it reduces comparability between grades that are subsequently integrated into GPA (Johnson, 1997) or produces ceiling effects (i.e., grades crowding into the upper limit of the grading range), resulting in range restriction and disrupted rank-ordering (LeBreton, Burgess, Kaiser, Atchley, & James, 2003), as well as non-normal distributions. These effects will tend to reduce observed correlations. If, however, grade inflation leads only to a constrained spread of grades (e.g., a standard deviation based on an effective rating scale of 6 to 10 versus 1 to 10), without changing rank ordering, that will not of itself affect correlations because they are computed on standardized variables.

It is reassuring then that when it is treated as a scale with grades as the component items, the internal reliability of GPA is relatively good. For example, Bacon and Bean (2006) reported an average intraclass correlation coefficient of .94 for four-year tertiary-level GPA, which is

substantially higher than the average Cronbach's alpha of .746 for measures of work performance (Viswesvaran, Ones, & Schmidt, 1996). Problems with the reliability of GPA would tend to affect the temporal stability of the measure as well as its correlations with other variables. Yet, meta-analytic correlations have been reported between GPA at secondary and tertiary levels of education (corrected $r = .54$: Kobrin, Patterson, Shaw, Mattern, & Barbuti, 2008; corrected $r = .46$: Schuler, Funke, & Baron-Boldt, 1990) indicating that GPA is reliable over time. GPA is consistently correlated with other variables such as intelligence (corrected $r = .56$: Strenze, 2007) and is a significant predictor of occupational criteria such as work performance (corrected $r = .35$: Roth, BeVier, Schippman, & Switzer III, 1996), and occupational status and prestige (corrected $r = .37$: Strenze, 2007), demonstrating criterion validity. Thus, although there are problems with grades and GPA, they remain useful measures of academic performance, making them appropriate for use in this meta-analysis.

Why should personality be related to academic performance?

At this juncture, it is important to consider why personality should be expected to be correlated with academic performance when most measures of personality, including the FFM, were not designed to predict academic performance (Ackerman & Heggestad, 1997). This contrasts with intelligence, the early empirical refinement of which was based partly on analyses of academic performance (Spearman, 1904), while many intelligence tests were specifically constructed to predict academic success or failure (Brown & French, 1979). There are, nonetheless, good reasons to expect that the FFM dimensions should predict academic performance, based on the theoretical position that guided its initial development. The theoretical basis for the FFM was provided by the lexical hypothesis (Allport & Odbert, 1936), the idea that there is an evolutionary advantage in being able to identify valuable differences between people

and that natural languages will therefore have developed in ways that would aid this identification (Saucier & Goldberg, 1996). A corollary of the lexical hypothesis is that the more valued the feature of personality, the more descriptors for that feature will be found within natural languages. This in turn implies that it should be possible to determine which features of personality are most valued and important by finding the largest groups of personality descriptors that have similar meanings.

The lexical hypothesis inspired factor analyses of comprehensive sets of personality descriptors, first in English and subsequently in other languages, resulting in the development and validation of the FFM (Saucier & Goldberg, 1996). The fact that the FFM has also been obtained from analyses of varied item-sets (e.g., Costa & McCrae, 1988; Goldberg & Rosolack, 1994; Goldberg, Sweeney, Merenda, & Hughes, 1996) and confirmed within different cultures (e.g., Hendriks et al., 2003) provides evidence not only for the FFM but also for the lexical hypothesis. Admittedly, other models of personality have been developed on the basis of the lexical hypothesis (e.g., Ashton et al., 2004; Saucier, 2003), but these models do not contradict the FFM – rather, they add to and, in the case of Saucier (2003), re-orient the FFM dimensions. The FFM remains by far the most widely researched personality model based on the lexical hypothesis, and hence forms the basis for the meta-analysis reported here.

If the lexical hypothesis is correct, then dimensions of the FFM should be related to behaviors and outcomes that have independently been recognized as important. Performance at work, mortality and divorce are all socially important outcomes, so the findings that the FFM dimensions are linked to work performance (Barrick et al., 2001) and have similar or stronger links with mortality and divorce than do either intelligence or socioeconomic status (Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007) are consistent with this reasoning. The substantial

investments in education by societies and individuals demonstrate the high value placed on educational performance, so it should also be associated with the FFM.

The idea that intelligence, socioeconomic status and personality each affect socially-valued behaviors is consistent with the proposal that performance in both work and academic settings is determined by factors relating to capacity to perform, opportunity to perform and willingness to perform (Blumberg & Pringle, 1982; Traag, van der Valk, van der Velden, de Vries, & Wolbers, 2005). Capacity incorporates knowledge, skills and intelligence; opportunity to perform is affected by environmental constraints and resources, including socioeconomic resources (Traag et al., 2005); while willingness to perform reflects motivation, cultural norms and personality (Blumberg & Pringle, 1982). Recent meta-analyses have provided evidence that both capacity and opportunity to perform are correlated with academic performance. For example, Strenze (2007) found a corrected correlation of .56 between intelligence and academic performance, while Sirin's (2005) meta-analysis obtained a corrected correlation of .32 between socioeconomic status and academic performance. Factors associated with willingness to perform, such as attendance, initiative, involvement in non-academic activities, and attitudes to study, have been shown to provide additional prediction of academic performance beyond that provided by mental ability (Willingham, Pollack, & Lewis, 2002). With respect to willingness to perform, the dimensions of the FFM may contribute directly but have been indirectly linked through their associations with motivation. For example, Judge & Ilies (2002) found that FFM measures provided a multiple correlation when statistically predicting goal-setting motivation. Therefore, it is reasonable to expect that — like other aspects of willingness to perform — personality, as measured by the FFM, should be correlated with academic performance.

Given these arguments, it is tempting to assume that correlations of personality with academic performance should mirror those with work performance. Some authors have argued that the two types of performance can be considered to be largely the same (e.g., Lounsbury, Gibson, Sundstrom, Wilburn, & Loveland, 2004), in part because schools prepare students for work “by structuring social interactions and individual rewards to replicate the environment of the workplace” (Bowles & Gintis, 1999, p. 3). However, there is also little evidence that what is learnt during formal education is actually transferred to the workplace (Haskell, 2001) and although tertiary level academic performance is correlated with job performance, this is not at a level that would imply they are the same (corrected $r = .35$: Roth, et al., 1996). Therefore, the similarities between academic and work performance may suggest similar relations with personality, but they are not strong enough to assume this conclusion.

Other arguments for linking personality with academic performance are based on previously observed correlations between these measures and various additional variables. As mentioned previously, personality and academic performance may be associated due to common links with intelligence. Consistent with this, Chamorro-Premuzic and Furnham (2006) argued that correlations between academic performance and personality measures would mirror corresponding correlations of intelligence with personality. Yet the relationship of intelligence with personality is complex with, for example, the strength of correlations between intelligence and Extraversion varying with participant age and research methodology (Wolf & Ackerman, 2005). Consequently, it is difficult to be confident on this basis about corresponding relationships with academic performance. Nonetheless, given the reliable associations of intelligence with academic performance, it would be difficult to interpret the relationship between personality and academic performance without considering the role of intelligence.

In summary, the strongest arguments for expecting that measures of personality based on the FFM should be correlated with academic performance relate to the evidence supporting the importance of personality factors for predicting socially valued behaviors and on the recognition of personality as a component of an individual's willingness to perform. At the same time, intelligence should be considered in order to adequately assess these relationships. This meta-analysis should be seen as a test of these positions.

Relationships of individual FFM dimensions with academic performance

Apart from the general arguments for expecting academic performance to be associated with personality, a range of independent arguments has been forwarded linking it with individual FFM measures. Many of these were reviewed by De Raad and Schouwenburg (1996), so the following discussion largely summarizes their work. De Raad and Schouwenburg (1996) argued that Agreeableness may have some positive impact on academic performance by facilitating cooperation with learning processes. This is consistent with later research that found Agreeableness was linked to compliance with teacher instructions, effort and staying focused on learning tasks (Vermetten, Lodewijks, & Vermunt, 2001). Conscientiousness as the FFM dimension most closely linked to will to achieve (Digman, 1989) — the *w* factor described by Webb (1915) — has often been linked to academic performance (De Raad & Schouwenburg, 1996). This factor is associated with sustained effort and goal-setting (Barrick, Mount, & Strauss, 1993), both of which contribute to academic success (Steel, 2007), as well as compliance with and concentration on homework (Trautwein, Ludtke, Schnyder, & Niggli, 2006), and learning-related time management and effort regulation (Bidjerano & Dai, 2007).

People who are low on Emotional Stability are more anxious and tend to focus on their emotional state and self-talk, thus interfering with attention to academic tasks, thereby reducing

performance (De Raad & Schouwenburg, 1996). More positively, Emotional Stability is associated with self-efficacy (Judge & Bono, 2002), which is positively correlated with academic performance (Robbins et al., 2004), indicating that Emotional Stability should similarly be correlated. De Raad and Schouwenburg (1996) argued that students who are high on Extraversion will perform better academically because of higher energy levels, along with a positive attitude leading to a desire to learn and understand. On the other hand, they cited Eysenck (1992) who suggested that these same students would be more likely to socialize and pursue other activities rather than studying, leading to lower levels of performance. Unfortunately, it is not clear from De Raad and Schouwenburg which of these effects is more likely to affect academic performance. Finally, De Raad and Schouwenburg (1996) stated that Openness appears to reflect “the ideal student” (p. 327), because of its association with being foresighted, intelligent and resourceful. Correspondingly, Openness is positively correlated with approach to learning (Vermetten, et al., 2001), learning motivation (Tempelaar, Gijsselaers, van der Loeff, & Nijhuis, 2007) and critical thinking (Bidjerano & Dai, 2007), but it also has the strongest negative correlation with absenteeism (Lounsbury, Steel, Loveland, & Gibson, 2004) of the FFM factors.

In summary, a range of arguments supports associations between academic performance and each of the FFM dimensions. Most of these arguments depend on correlations between FFM measures and other constructs that have been associated with academic performance. Although suggestive, such arguments are inconclusive because the correlations cited in the various studies are not strong enough to definitively establish the corresponding FFM–academic performance relationships. This emphasizes the importance of directly testing the relationships between the FFM dimensions and academic performance.

Potential Moderators of Academic Performance–Personality Correlations

Although meta-analysis is a useful tool for integrating research findings, one of its major advantages is that it allows an examination of the extent to which findings are due to either random sampling error or systematic variations (heterogeneity) between studies (Hunter & Schmidt, 2004). Such heterogeneity indicates the presence of moderators of observed relationships and it is valuable to identify both the existence and the nature of these moderators (Steel & Kammeyer-Mueller, 2002). Two potential moderators of the relationship between personality and academic performance were examined in this research. Previous researchers have found that as academic level rose from primary to tertiary education, correlations of academic performance with intelligence declined (Jensen, 1980), correlations with gender rose (Hyde, Fennema, & Lamon, 1990), and correlations with socioeconomic status (Sirin, 2005) and measures of self-concept (Hansford & Hattie, 1982) first rose, then fell. The increasing diversity of educational and assessment practices at higher levels of education (Tatar, 1998) could help to explain this. Such diversity may result in changes in the constructs being measured by grades and GPA, leading to changes in correlations with other variables. Alternatively, the moderating effect of academic level may be due to the presence of methodological artifacts. Reduced participation in education at higher academic levels can lead to range restriction (Chamorro-Premuzic & Furnham, 2006; Jensen, 1980). This is likely to reduce observed correlations, but would not account for rising correlations with gender, or the more complex relationships with socioeconomic status and self-concept. Regardless of the explanation, the previously-observed potency of academic level as a moderator of correlations with academic performance means it should be examined as a potential moderator of correlations between academic performance and personality.

Farsides and Woodfield (2003) argued that age also moderates personality–academic performance correlations; however, these authors did not specifically test this. Increasing age is associated with reduced correlations between academic performance and intelligence (Laidra, Pullman, & Allik, 2007), but has also been observed to moderate other relationships with academic performance. For example, the relationship between Emotional Stability and academic performance has been observed to become more positive with older students, at least in primary education (De Raad & Schouwenburg, 1996), and it has been suggested that age produces a stronger negative correlation between Extraversion and academic performance among secondary education students (Eysenck & Eysenck, 1985). Yet, the effect of age on these correlations has not been systematically examined, so its true effect remains an open question. Academic level and age are associated, but age has different consequences at different educational levels: cognitive performance is significantly more amenable to practice effects at younger ages (Lindenberger, Li, Lövdén, & Schmiedek, 2007) and a year of aging produces different outcomes for students in primary, secondary or tertiary education. Consequently, an effective analysis of the moderating effects of age and academic level requires an examination of the interaction of these variables.

In summary, this meta-analysis was undertaken to thoroughly review the relationship between measures of the FFM and academic performance. This allowed a test of the extent to which the FFM dimensions, as components of students' willingness to perform academically, were linked to academic performance, as well as testing the lexical hypothesis, and the extent to which these relationships mirrored relationships between intelligence and academic performance. At the same time, it provided the opportunity to examine the moderating influence of academic level and age upon academic performance–personality correlations.

Method

Sample

A search of the following databases was conducted in order to identify relevant articles for this review: PsycINFO (a database referencing psychology research); ISI Web of Science databases (referencing science, social science, and arts and humanities publications); MEDLINE (lifesciences and biomedical research); ERIC (education publications); and ProQuest Dissertations and Theses database (unpublished doctoral and thesis research). The database searches used the following terms and Boolean operators: (academic OR education OR university OR school) AND (grade OR GPA OR performance OR achievement) AND (personality OR temperament). All articles that had been published and all dissertations that had been presented prior to the end of 2007 were considered for inclusion within the meta-analysis. Abstracts of the studies identified with this search were then reviewed in order to identify articles that may be relevant. Copies of these articles were obtained then examined to determine whether at least one or more measures that had been designed to assess the FFM had been correlated with measures of academic performance. Unusual inclusions were the studies by Duff, Boyle, Dunleavy, and Ferguson (2004) and Moseley (1998), which used a version of the 16PF that had been specifically revalidated to assess the FFM. Although restricting the meta-analysis to FFM measures excluded correlations with comparable measures, such as the Extraversion and Neuroticism scales of the Eysenck Personality Questionnaire (Eysenck & Eysenck, 1975), it had the advantage of ensuring that all studies used measures that had been validated as assessing the FFM dimensions.

Articles that only reported on measures that were not specifically related to academic outcome were excluded from the meta-analysis. For example, Stewart (2001) used a measure of past performance that actually assessed participants' reactions to their performance, rather than

their academic performance *per se*, while Hogan and Holland (2003) reported a meta-analytic correlation with a measure called “school success”, which in fact is a personality measure.

Correlations with measures of class attendance or course completion were also excluded.

Care was taken to exclude studies that were based on the same data-set as a study that had already been included in the meta-analysis. For example, a research team based at the University of Tennessee has published a series of articles that presented correlations between FFM measures and GPA in school students (Barthelemy, 2005; Dunsmore, 2006; Friday, 2005; Lounsbury, Gibson, & Hamrick, 2004; Lounsbury, Gibson, Sundstrom, Wilburn, & Loveland, 2004; Lounsbury, Steel, Loveland, & Gibson, 2004; Lounsbury, Sundstrom, Loveland, & Gibson, 2003a, 2003b; Loveland, Lounsbury, Welsh, & Buboltz, 2007; Perry, 2003). The most inclusive of these samples appears to be that reported by Perry (2003), so that was used in this study. However, the data reported by Perry (2003) did not cover samples of primary level students, so these were obtained from the relevant articles (Lounsbury, Gibson, & Hamrick, 2004; Lounsbury, Gibson, Sundstrom, et al., 2004; Lounsbury, et al., 2003a, 2003b). Similarly, although Lounsbury et al., (2003a; 2003b) and Loveland, et al., (2007) addressed different research questions, the correlations reported by Loveland et al., (2007) that were relevant to this meta-analysis appear to be based on samples used in the other articles, so the Loveland et al. correlations were excluded. Other studies that were excluded from the meta-analysis because they had been covered elsewhere were the studies by Loveland (2004) and Rogers (2005). At the end of this process, a list of 80 research reports (63 published articles and 17 unpublished dissertations) had been compiled.

Coding

In some cases, more than one set of correlations was reported from the same sample (e.g., Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2006 present correlations with grades in several courses as well as with GPA). When these correlations were with academic performance criteria at different educational levels (e.g., Woodfield, Jessop, & McMillan, 2006 present correlations with both secondary and tertiary education performance), both correlations were included in the sample. However, when these correlations were each based on measures at the same academic level (e.g., tertiary education), the correlations with the most broadly-based academic performance measure were used (i.e., course grade was used in preference to individual assessments and GPA used in preference to course grade). An exception to this was if the more broadly-based measure was obtained using self-report (e.g., Conard, 2006; and Ridgell & Lounsbury, 2004 used both self-reported GPA and a course assessment). For these cases, the independently assessed measure was used in order to minimize common-method bias. Only three sets of correlations based on self-reported academic performance were used (i.e., Day, Radosevich, & Chasteen, 2003; Gray & Watson, 2002; and Lounsbury, Huffstetler, Leong, & Gibson, 2005).

One study (Schmit, Ryan, Stierwalt, & Powell, 1995) reported correlations using multiple administration variations for the FFM, only one of which was directly comparable to that used in the other studies. Specifically, Schmit et al. (1995) requested students to rate their personality using either standard instructions or using a specific frame-of-reference, such as “at work.” Only the results obtained using standard administration procedures were used in this meta-analysis. When articles included multiple relevant correlations from the same sample(s), averages of the correlations with the various performance measures were calculated for use in the meta-analysis. Another issue related to FFM measures is the use of diverging labels for the same

scales. Apart from taking care when coding, this becomes most important with respect to the Emotional Stability dimension, which is often called Neuroticism, reflecting the opposite pole of the same measure. In this case, all correlations between Neuroticism and academic performance had their arithmetic sign reversed (e.g., minus to plus) when coding results, to allow comparability. Many of the articles in the database also reported correlations with measures of intelligence. For the purposes of the analyses presented here, scores on the SAT and the ACT were used as measures of intelligence because both have been found to be valid measures of this factor (Frey & Detterman, 2004; Jackson & Rushton, 2006; Koenig, Frey, & Detterman, 2008).

Some studies did not report conventional correlations. For example, Cucina and Vasilopoulos (2005) only reported standardized regression weights, but Hunter and Schmidt (2004) claimed that standardized regression weights could be validly used in meta-analyses in place of correlations. By contrast, Wu (2004)'s regression weights were unstandardized, so they were converted using standard deviations of predictor and criterion variables (Bring, 1994). Standard deviations for the FFM scales used by Wu (2004) were obtained from Wu, Lindsted, Tsai, and Lee (2008), but the standard deviation for the academic performance measure was calculated from the average of the 95% confidence intervals reported by Wu (2004).

Wherever possible, studies were coded with respect to the proposed moderators by using data from the original report. Unfortunately, several studies did not report information on age, but among studies that did so there was a strong correlation (over .9) between year of study (e.g., grade 10 of secondary education, or second year of tertiary education) and age. Consequently, if average age was not directly reported, it was estimated on the basis of the year of study, with the estimated age based on the average ages in other studies that used students in a similar year.

Statistical Corrections

For nearly two-thirds of the studies in this meta-analysis, FFM standard deviations were unavailable for either the study sample, the original validation sample for the scales used, or both. This precluded accurate assessment of range restriction on the FFM scales. Compulsory education at primary and secondary level in the countries from which the studies were drawn reduces the amount of selection bias with respect to academic performance, although this may become more of an issue at ages that exceed the minimum school-leaving age. Tertiary education is different, with many tertiary institutions restricting access based on prior academic performance, thereby creating range restriction. However, none of the studies reported the selection ratios used by the participating tertiary institutions. There do not appear to be valid methods for estimating this form of range restriction, so no correction was used for range restriction with academic performance. Although unsatisfactory, this is at least consistent with many previous meta-analyses in which GPA was a criterion variable (e.g., Kuncel, Crede, & Thomas, 2005; Kuncel, Hezlett, & Ones, 2001, 2004).

Estimates of Cronbach's alpha provided by each study were used wherever possible to correct correlations. Where studies did not report an estimate of alpha, estimates were obtained from the original validating studies for the relevant personality scale. If no validating study was available, an estimate of alpha derived from Viswesvaran and Ones's (2000a) meta-analysis of FFM reliabilities was used. Only three studies reported estimates of alpha for academic performance (Bartone, Snook, & Tremble Jr., 2002; Ferguson, Sanders, O'Hehir, & James, 2000; Lievens & Coetsier, 2002); however, Farsides and Woodfield (2003) reported sufficient data to allow it to be calculated. For other studies, GPA was corrected using estimates of alpha obtained from Bacon and Bean (2006), who provided estimates of GPA for periods ranging from one to four years of study, while, self-reported GPA was corrected with Kuncel et al.'s (2005) estimate

of measurement reliability for self-reported college GPA (.90). For studies that relied on single academic assessments, the estimates of alpha reported by Chamorro-Premuzic, Furnham and Ackerman (2006) were used. In all cases, correlations were corrected for scale reliability prior to combining the correlations into overall estimates.

Results

Substantial aggregated sample sizes were obtained for correlations with each FFM dimension (from 58,522 for correlations with Agreeableness to 70,926 for correlations with Conscientiousness). In comparison, Barrick et al.'s (2001) second-order meta-analysis included a larger number of independent workplace samples (total $k = 976$) but their aggregated sample sizes were substantially less (ranging from $N = 23,225$ to $N = 48,100$). Thus, this meta-analysis provides a high level of power for statistically predicting academic performance.

After coding the statistics, an initial meta-analysis was conducted with all correlations for each FFM dimension and intelligence. This initial analysis was conducted using the Hunter and Schmidt (2004) random-effects method, in order to estimate population values for r and ρ , as well as credibility values for the distribution of ρ and Cochran's Q as an estimate of sample heterogeneity. Credibility values and Q were calculated on the basis of correlations that were corrected for internal reliability (alpha). Although Cochran's Q is commonly reported, I^2 (Higgins & Thompson, 2002) has been recommended as a supplement to Q when assessing heterogeneity (Huedo-Medina, Sánchez-Meca, Marín-Martínez, & Botella, 2006) because, unlike Q , I^2 allows researchers to quantify heterogeneity and to compare the degree of heterogeneity within different analyses. Thus an I^2 value of 25% indicates that one quarter of the variation between studies reflects systematic or heterogeneous variation, rather than random sampling error.

The results of the initial meta-analysis are presented in Table 1. A meta-analysis of the relationship of intelligence with academic performance, derived from the same database, is also reported in Table 1 to allow a comparison based on similar methodologies and to facilitate further analyses. The results in Table 1 show that each of the FFM dimensions had correlations with academic performance that were statistically significant, but with large sample sizes correlations can be statistically significant yet practically meaningless. To make the results more practically meaningful, the correlations were converted to Cohen's d (Olejnik & Algina, 2000), which in this case can be interpreted as equivalent to the number of standard deviations between the mean levels of academic performance in groups that are either high or low on a specific FFM measure. It has previously been suggested that d effect sizes of around .2 may be considered small, .5 medium, and .8 large (Cohen, 1988). Thus, the average relationship of academic performance with Conscientiousness ($d = .46$) can be seen as a medium-sized effect, the relationships with Agreeableness ($d = .14$) and Openness ($d = .24$) as small effects, and the relationships with Emotional Stability and Extraversion as relatively minor. Cohen's d can further be converted to an equivalent grade value using the standard deviation of the criterion measure. The average standard deviation for GPA among the studies used in the meta-analysis was .68, so in terms of GPA, the d for Conscientiousness represents an increase of .31 of a grade. Assuming that grades are normally distributed in a program where the overall failure rate is 10%, this effect size would mean that students in that program who are low on Conscientiousness would be nearly twice as likely to fail. Clearly, doubling the likelihood of failure is a practically significant student outcome. Thus, the idea that the FFM dimensions would be associated with the socially-valued outcome of academic performance has been confirmed.

Many of the studies included within the current meta-analysis reported correlations between intelligence and academic performance. The meta-analysis of these results, reported in Table 1, shows a corrected correlation of .25, which is smaller but comparable with estimates of the correlation between the SAT and academic performance when not corrected for range restriction (i.e., secondary level GPA $r = .28$; tertiary-level GPA: $r = .35$: Kobrin, et al., 2008). It may be concerning to know that this estimate is substantially lower than Strenze's (2007) estimate of the correlation between intelligence and academic performance ($r = .56$), but that estimate was based on samples that had little or no range restriction. Kobrin et al. (2008) also presented estimates that were corrected for range restriction ($r = .53$ for secondary and tertiary education), which approximated Strenze's (2007) estimate. Therefore, it appears that the estimate of the correlation between academic performance and intelligence, presented in Table 1, is valid, so it is noteworthy that this correlation is of similar size to the correlation with Conscientiousness. The effect size for Conscientiousness is also of similar but smaller magnitude to previously-reported average effect sizes for instructional design strategies ($d = .62$: Arthur Jr., Bennett Jr., Edens, & Bell, 2003) and socio-economic status ($r = .32$; $d = .68$; grade difference = .46: Sirin, 2005) neither of which were corrected for range restriction. Thus, the link between academic performance and Conscientiousness is of comparable importance to links between academic performance and a range of other constructs.

The FFM measures showed generally modest scale-corrected correlations with intelligence in this meta-analysis (i.e., Agreeableness: .01; Conscientiousness: -.03; Emotional Stability: .06; Extraversion: -.01; Openness: .15). As observed by Ackerman and Heggestad (1997), Openness had the highest correlation with intelligence but this did not translate into Openness having the highest correlation with academic performance. Controlling for intelligence

had some effect on the correlations reported in Table 1, with the largest effects being to reduce the correlation with Openness from .12 to .09, while the correlation with Conscientiousness actually increased, due to its negative correlation with intelligence. Thus, this analysis is inconsistent with Chamorro-Premuzic and Furnham's (2006) argument that links between personality and academic performance will largely be due to common links with intelligence.

 Insert Table 1 around here

The significant Q statistics for correlations with each of the FFM factors, as well as intelligence, indicate the presence of heterogeneity among the correlations, while the values for I^2 show that most of the variation between samples is systematic. These points indicate the existence of substantial moderators of the relationship between the FFM dimensions and academic performance. A range of statistical tools has been used to analyze summary results for the presence of moderators, but some of these techniques can be problematic. Specifically, the use of correlation, ordinary least squares regression, or Hunter and Schmidt's (2004) hierarchical sub-group analysis can produce biased and unreliable estimates in the presence of skewed sample size distributions or multicollinearity (Steel & Kammeyer-Mueller, 2002). In contrast, weighted least squares regression with sample size used to weight observations is relatively unbiased under similar conditions, especially with larger numbers of studies (Steel & Kammeyer-Mueller, 2002). In this meta-analysis, the sample size distribution was highly skewed (skew = 6.62; standard error of skew = .21; $p < .001$) so weighted least squares regression was used for the moderator analyses. Corrected correlations are more directly comparable than raw correlations (Schmidt & Hunter, 1996), so they were used as the criterion variables.

Accordingly, weighted least-squares multiple regression analyses are reported in Table 2, along with sample-weighted scale-corrected correlations for each academic level. For these regression analyses, academic level was the predictor of corrected correlations with academic performance. Correlations based on samples that included students from more than one academic level were excluded from all analyses of academic level (i.e., Barbaranelli, Caprara, Rabasca, & Pastorelli, 2003; Slobodskaya, 2007). Although it may be argued that academic level is an ordinal variable, the qualitative differences between education at different levels (Tatar, 1998) leave this open to question. On the other hand, if academic level were truly ordinal, then treating it as nominal could reduce statistical power. Consequently, the regression analysis was conducted twice, first treating academic level as a nominal variable, using dummy coding, and then as an ordinal variable (not reported). Apart from being easier to interpret, the models based on dummy coding were also statistically more significant, apparently because they took into account non-linear relationships, so these regression analyses were reported. It should be noted that, for the purposes of these analyses, primary level was left uncoded, and hence the estimates for the constant in the multiple regression equations reflect primary level.

It is clear from Table 2 that academic level was a potent moderator of correlations between academic performance and several aspects of personality. Specifically, there was a decline in strength of correlations of academic performance with each FFM dimension, apart from Conscientiousness, from primary to secondary level, and from primary to tertiary level, while only correlations between academic performance and Openness declined from secondary to tertiary level. It should be acknowledged that roughly two-fifths of the tertiary-level sample was derived from studies using psychology students. A separate analysis (not reported) showed that the only significant difference between studies based on psychology courses and other

tertiary courses was that there was a slightly higher correlation of academic performance with Conscientiousness in psychology ($r = .28$), which will have increased the correlation with tertiary academic performance overall. In summary, although academic level had a significant moderating effect, this varied depending on which dimension of the FFM and which academic levels are considered.

Also presented in Table 2 are the results of examining the moderating effect of academic level on correlations with intelligence. These too were significantly affected by academic level, falling significantly from primary to secondary education, an observation which is consistent with previously observed declines in correlations with intelligence due to range restriction (Jensen, 1980). The meta-analytic correlations between intelligence and academic performance were used to calculate partial correlations between FFM measures and academic performance, while controlling for intelligence. As observed with the overall meta-analysis, controlling for intelligence did have an effect on correlations with academic performance. When intelligence was controlled for, correlations with Extraversion and Emotional Stability were most reduced by controlling for intelligence at the primary education level. At all levels, correlations with Agreeableness were least affected by controlling for intelligence, while correlations with Conscientiousness increased slightly at the secondary and tertiary levels.

This analysis allowed an examination of the incremental prediction of tertiary level GPA by FFM measures, over that provided by secondary level GPA, in similar fashion to an assessment of the validity of SAT presented by Kobrin et al. (2008). Past behavior is typically the best predictor of future behavior (Ouelette & Wood, 1998), so controlling for past behavior — such as past academic performance — means this is a particularly rigorous test. A meta-analytic estimate of the correlation between secondary- and tertiary-level GPA was obtained on

the basis of the studies in the database that reported correlations between secondary and tertiary GPA (eight studies with a total N of 1581). The resulting scale-corrected correlation was .35, a figure that is similar to the estimate of .36 (uncorrected for range restriction) provided by Kobrin et al. (2008). When controlling for secondary GPA, the partial correlations of the FFM measures with tertiary GPA were: Agreeableness $r_{\text{partial}} = .05$; Conscientiousness $r_{\text{partial}} = .17$; Emotional Stability $r_{\text{partial}} = -.01$; Extraversion $r_{\text{partial}} = .00$; and Openness $r_{\text{partial}} = .03$. By way of comparison, the corresponding partial correlation of intelligence with tertiary GPA was .14. Thus, apart from Conscientiousness, the FFM measures added little to the prediction of tertiary GPA over that provided by secondary GPA. However, Conscientiousness added slightly more to the prediction of tertiary GPA than did intelligence, so has again been found to be a comparatively important predictor of academic performance.

 Insert Table 2 around here

Westen and Rosenthal's (2003) indexes were used to assess the similarity between the correlations obtained in this meta-analysis and those reported by Barrick et al. (2001) in their meta-analysis of the FFM and work performance (i.e., scale-corrected correlation of work performance with Agreeableness: .13; Conscientiousness: .27; Emotional Stability: .13; Extraversion: .13; Openness: .07). Westen and Rosenthal's alerting index ($r_{\text{alerting-CV}}$) provides an indication of the level of agreement between observed and predicted correlations but does not allow a test of significance, while their contrast index ($r_{\text{contrast-CV}}$) provides a test of significance but does not provide a valid estimate of the level of agreement with expectations, so these indexes need to be used together. For the following analyses, the average aggregate sample sizes

reported in Tables 1 and 2 were used to calculate the significance level. When the estimates obtained from the total sample (i.e., Table 1) are compared with Barrick et al.'s estimates, the level of agreement between correlations of academic performance and the FFM measures was substantial and significant ($r_{\text{alerting-CV}} = .64$; $r_{\text{contrast-CV}} = .12$; $p < .001$). Interestingly, the degree of agreement between the correlations reported here and those reported by Barrick et al. (2001) increased from primary ($r_{\text{alerting-CV}} = .37$; $r_{\text{contrast-CV}} = .04$; $p < .05$) to secondary ($r_{\text{alerting-CV}} = .60$; $r_{\text{contrast-CV}} = .11$; $p < .001$) and tertiary levels of education ($r_{\text{alerting-CV}} = .15$; $r_{\text{contrast-CV}} = .79$; $p < .001$). Thus, academic and work performance show more similarity in their relationships with the FFM measures at higher levels of education.

In order to test the moderating effect of age on correlations between FFM measures and academic performance, a series of weighted least squares regressions were conducted, with sample average age as the predictor and corrected correlations as the criterion variables. The results of these analyses are reported in the first column of Table 3. Sample average age was found to have significant moderating effects on correlations with Agreeableness, Emotional Stability, and Openness. Yet average age within a sample was correlated with academic level (sample-weighted $r = .864$), so the moderating effects of age may have been confounded with those of academic level. To test this, analyses of the effect of age within each academic level were undertaken, in order to control for the effect of academic level. The results of these analyses are reported in the remaining columns of Table 3. Splitting the aggregate sample in this manner reduces statistical power (Steel & Kammeyer-Mueller, 2002) so the number of significant effects is noteworthy, and demonstrates that the relationship between age and academic performance is relatively complex. At the primary level, increasing age was associated with higher correlations of academic performance with Conscientiousness, Emotional Stability

and Extraversion, and lower correlations with Openness. At the secondary level, increasing age was associated with declining correlations with Agreeableness, Emotional Stability, and Openness. No significant moderating effects of age on correlations with academic performance were observed at the tertiary level.

 Insert Table 3 around here

In summary, the results of this meta-analysis showed that academic performance was associated with measures based on the FFM, especially measures of Conscientiousness. Conscientiousness had an overall association with academic performance that was of similar magnitude to that of intelligence. Correlations of FFM measures with intelligence were not mirrored by their correlations with academic performance, and controlling for intelligence had little effect on these correlations — findings that ran counter to the expectations of earlier writers. Of the FFM measures, only Conscientiousness retained most of its association with tertiary academic performance when secondary academic performance was controlled for. Yet this relatively clear picture belies the fact that most of the variation between samples was systematic. The consequent moderator analyses explicated some of this underlying complexity. Correlations of academic performance with each of the FFM measures, apart from Conscientiousness, were reduced as educational level rose, while correlations with Agreeableness, Emotional Stability and Openness all decreased with student age. Age interacted with academic level to produce different effects in primary, secondary, and tertiary education for each FFM dimension.

Discussion

This meta-analysis has provided the most comprehensive statistical review of the relationship between personality and academic performance to date and has confirmed the prediction of various writers since the early twentieth century that will or Conscientiousness would be associated with academic performance. It is clear that dimensions of personality identified on the basis of the lexical hypothesis can provide practically useful levels of statistical prediction of the socially important criterion of academic performance. Unlike measures of intelligence, personality measures based on the lexical hypothesis were not designed to predict academic performance, so it is especially noteworthy that Conscientiousness and intelligence had similar levels of validity at both the secondary and tertiary levels of education. Future researchers and academics therefore need to seriously consider the role of personality, especially Conscientiousness, within academic settings.

Some confirmation of the idea that personality would play a similar role in academic performance to the one it plays in work performance was provided by the fact that Conscientiousness was confirmed as the strongest FFM predictor of academic performance, just as it has been found to be the strongest FFM predictor of academic performance. Further parallels resulted from the comparison of correlations in the two settings using Westen and Rosenthal's (2003) indexes. These showed that, with respect to the role of personality, "school" becomes more like work as students progress through their academic careers.

Likewise, the pattern of correlations in the overall meta-analysis did not reflect the strength of correlations between intelligence and measures of the FFM. Further, controlling for intelligence had only minor effects on the validity of the FFM measures, so the argument that relationships between personality and academic performance are based purely or even largely on their mutual relationships with intelligence is unsustainable. Instead, the FFM dimensions appear

to be part of the set of factors that contribute to performance by affecting students' willingness to perform. Although Agreeableness, Conscientiousness, and Openness had validities in the overall sample that were practically significant, these validities were considerably smaller than the validity of Conscientiousness. Only Conscientiousness had more than a trivial partial correlation with tertiary academic performance when secondary academic performance was controlled for.

From a practical perspective, the results presented here have several implications. Apart from previous academic performance, intelligence is probably the most used selection tool for entrance to tertiary education, based on its well-established validity (Kobrin, et al., 2008; Strenze, 2007). However, the usefulness of intelligence as a predictor of future academic performance is reduced by its substantial overlap with previous academic performance and because in real world applications selection panels are working with range-restricted groups of applicants and cannot correct for measurement and methodological artifacts. Consequently, the finding that within this research Conscientiousness showed similar levels of validity to intelligence indicates that it is likely to have similar levels of practical utility, provided it can be validly assessed. This qualification is important — faking is a much stronger possibility when measuring personality rather than intelligence — and puts a premium on the construct validity of any personality measures that may potentially be used for selection into academic programs. The use of valid, educationally-based measures should be further encouraged by the findings that the effect size for Conscientiousness is comparable with that of instructional design and that Conscientiousness has a practically important association with failure rates.

In this context, FFM measures should also be useful for identifying students who are likely to under-perform. Under-performance by capable students has been a major concern at least since the middle of the previous century (Stein, 1963). The finding that measures of

personality can predict which students are more likely to fail should prompt the use of these measures for identifying students who are at risk, allowing them to be targeted for assistance programs. Such programs could well attempt to address personality-related deficits. For example, it appears that students who are low on Conscientiousness may well fail because of reduced effort and poor goal-setting (Barrick, et al., 1993), so these students may benefit from training or guidance in these areas. Alternatively, teaching methods may be adjusted to adapt to the specific personality styles of students in order to assist their learning.

Practitioners should, nonetheless, be cautious in applying the results of this research because of the finding that substantial proportions of variations between studies was systematic, rather than random. In this light, it is not surprising that earlier reviewers of personality's role in academic performance concluded that results were "erratic," but this means that the correlations reported here need to be interpreted with respect to various moderators. One moderator that may account for much of this systematic variation is varying levels of range restriction between samples in the meta-analysis. The differences between the estimates of the validity of intelligence in this meta-analysis compared with previous studies (e.g., Kobrin et al., 2008; Strenze, 2007) are consistent with the existence of substantial range restriction in the post-primary samples. The inability to assess range restriction is a shortcoming of this study but other moderators were able to be assessed, namely academic level and age.

Academic level

Correlations of academic performance with all the FFM measures, except Conscientiousness, decreased from primary to secondary and from secondary to tertiary education. The decline in these correlations from primary to secondary and tertiary levels appears to mirror the previously mentioned decline in correlations between academic

performance and intelligence. Researchers on intelligence attribute this decline to increasing levels of range restriction (Jensen, 1980), a factor that was not controlled for in this study. However, if range restriction is used to explain the decline in correlations with most of the FFM measures, it implies that the underlying true correlation between Conscientiousness and academic performance may well increase substantially from the primary to tertiary level of education because it showed no concomitant decline.

An alternative explanation relates to the increasing variety of learning environments and activities experienced by students as they progress through their educational careers. It is common for primary school children to have a standard curriculum within their school, state, or nation, but secondary and tertiary education tend to be far more varied (Tatar, 1998). Any interactions between personality and learning environments would tend to cloud and reduce overall correlations between personality and academic performance, potentially leading to declines in correlations. This would include cases in which different learning environments produced different levels of grade inflation. If this is the reason for the moderating effect of academic level, the matching of specific personality dimensions with specific academic criteria should be pursued, much as has been advocated with respect to workplace criteria (Tett, Steele, & Beauregard, 2003).

Age

Age was found to moderate academic performance–personality correlations, with correlations with Agreeableness, Emotional Stability and Openness declining significantly as sample average age increased. Although there has been considerable research on the measurement of personality throughout the lifespan (see Caspi, Roberts, & Shiner, 2005 for a review), few studies have examined the effect of age on the predictive validity of personality, so

the results of this meta-analysis are an important addition to knowledge in this area. However, these results need to be considered in conjunction with the finding of the significant interaction between age and academic level, and correlations between personality and academic performance.

Interaction of age and academic level

A further level of complexity was added by the significant interaction between academic level and age to produce complex patterns of academic performance–personality correlations. Correlations between academic performance and personality rose and fell depending on the FFM dimension and whether the correlation was obtained from samples in primary or secondary level of education. One possible explanation for these moderating effects is based on the validity of measurement of personality and academic performance. Measurement of personality in childhood, adolescence, and adulthood are different. During the primary school years, children undergo complex developmental processes, including changes in cognitive complexity and psychological understanding (Wellman & Lagattuta, 2004), which are likely to affect their ratings of their own personality and hence moderate the correlation between personality and academic performance. To be fair, the studies in this meta-analysis that examined children all utilized measures that were designed and validated specifically for children (cf., Laidra et al., 2007; Lounsbury, Gibson & Hamrick, 2004), and children's self-ratings of personality show sound levels of temporal reliability (Caspi, et al., 2005), demonstrating that they continue to measure similar underlying constructs over time. However, the factor structure and construct validity of younger children's self-assessments is less consistent than for adults, and improves with age (Allik, Laidra, Realo, & Pullman, 2004; Lewis, 2001). Problems with factor structure and construct validity will reduce correlations with independent variables, so the increase with

age of correlations between academic performance and Conscientiousness, Emotional Stability and Extraversion during primary education may be a function of growing levels of construct validity of children's self-assessments. If this is accepted, and it is further accepted that children are increasingly accurate in their self-assessments by the time they finish primary education, this would mean that the correlations at that time are the most accurate reflections of the true relationship between personality and performance at the primary level.

Increasingly valid measurement of personality at the primary education level may also account for changes in correlations of Openness with academic performance, even though these correlations fell rather than rose with increasing age. Openness is correlated with academic self-efficacy and academic self-confidence (Peterson & Whiteman, 2007), so younger children may be estimating their Openness partly on the basis of these factors. Specifically, younger children may conflate their academic success and associated levels of knowledge and enjoyment of study with aspects of Openness, such as being open-minded. If so, it means their self-assessments of Openness will be less valid, and that increased validity of assessment with age should result in declines in correlations between Openness and academic performance. Thus, the observed moderating effects of age on correlations in primary education may be due to increasing levels of validity of measurement of this personality factor.

Just as increasing validity of measurement of personality may account for changes in correlations at the primary level, changes in the measurement of academic performance may help to explain the declines in correlations with Agreeableness, Emotional Stability and Openness with increasing age at the secondary level. One reviewer highlighted that grading practices at different educational levels are subject to different pressures and that this can affect the nature of academic assessment. At all levels, teachers face various social pressures with respect to grading,

based on their relationships with students and parents, and are subject to bias associated with social desirability (Felson, 1980; Zahr, 1985). However, the importance of grades rises as students progress through their secondary and tertiary education, because the consequences for future study and career become increasingly salient. Students in primary education also have much closer relationships with fewer teachers than they do in secondary education, while it is common for tertiary-level teachers to have relatively distant relationships with students. Thus, the relative weighting on achievement-oriented assessment practices, as opposed to assessments that reflect social relationships, would tend to rise as students progress through their academic careers. What this means is that assessments of academic performance should be increasingly less associated with relationship factors as students age.

In primary education, the higher activity levels associated with Extraversion may affect ratings by making a student more visible, thus affecting the ability of teachers to recall students' performance, which is a significant moderator of performance ratings (Murphy & Cleveland, 1995). This effect would decline as relationships with teachers become more distant in secondary education. Agreeableness, Conscientiousness and Emotional Stability are all associated with social desirability (Digman, 1997), which has also been shown to affect performance ratings (Murphy & Cleveland, 1995). Consequently, as assessments become more learning-orientated and less socially-influenced, the association between measures of academic performance and those associated with social desirability should fall, and the association with Agreeableness and Emotional Stability apparently fell in step with that. On the other hand, correlations with Conscientiousness remained stable throughout secondary and tertiary education, suggesting that this dimension is not only socially desirable but also continues to facilitate learning. These arguments do not necessarily imply that academic performance assessment in primary education

is invalid, because not all halo is invalid (Hoyt, 2000) and social desirability can itself be a valid predictor of objective performance (Ones, Viswesvaran, & Reiss, 1996). However, it would mean that the construct-level relationship reflected by the observed correlations between personality and academic performance may be relatively complex. Future research is needed to determine the validity of these explanations of the process by which these FFM measures are linked to academic performance.

A further effect may add to the decline in correlations with Emotional Stability at the secondary level. This dimension of personality has been found to moderate responses to stressors (Suls & Martin, 2005) in such a manner that students who are low on Emotional Stability will perform worse on stressful tests of ability (Dobson, 2000). Yet, among people with higher intelligence, Emotional Stability has no relationship with performance on tests, apparently because intelligence provides greater capacity for managing one's emotional responses (Perkins & Corr, 2006). Upwardly restricting the range of intelligence in students, which is believed to occur as students progress through their academic careers (Jensen, 1980), may mean that only the more intelligent students with low levels of Emotional Stability are retained in formal education. These students may well have learnt strategies for managing their emotional reactions so that their academic performance would not be affected by their level of Emotional Stability. If older students with low Emotional Stability generally found tests, examinations and other academic activities progressively less stressful, the advantage of having higher levels of Emotional Stability would decline, as would correlations between academic performance and Emotional Stability.

Limitations

Every research study involves making tradeoffs, and whereas this study was aided by the use of broad, commonly-used measures of both personality (the FFM) and academic performance (GPA), the use of these broad measures was also a significant limitation. These broad factors facilitate comparability but hide details of relationships that may become apparent with finer-grained analysis. For example, the complexities of relationships between intelligence and personality, especially Extraversion (Wolf & Ackerman, 2005), have not been addressed in this research. Other methodological limitations that have been mentioned, such as the lack of correction for range, may have led to substantial underestimates of the strength of correlations. Future research on the extent of range restriction at different academic levels would be helpful, as would be the reporting of levels of range restriction by future researchers. This would not only make meta-analyses easier — it would also make interpretation of results more accurate (Schmidt & Hunter, 1996).

A further limitation was that it was not possible to test for the presence of non-linear relationships between personality and academic performance. Eysenck & Cookson (1969) found that the association of academic performance with Neuroticism was non-linear, while Cucina and Vasilopoulos (2005) reported the presence of curvilinear relationships with Openness and Conscientiousness. Even strong non-linear relationships may not produce significant linear correlations and non-linearity can mask co-existing linear relationships. The existence of either of these situations would mean the results reported here may underestimate the overall correlations between personality and academic performance. Future researchers are encouraged to examine their research for the presence of non-linearity in associations between academic performance and personality.

Conclusion

In their review, De Raad and Schouwenburg (1996) concluded that “personality usually comes at the bottom of the list of theorizing” (p.328) about learning and education. The results of this meta-analysis indicate that personality should take a more prominent place in future theories of academic performance, and not merely as an adjunct to intelligence. This research has demonstrated that the optimism of earlier researchers on academic performance–personality relationships was justified; personality is definitely associated with academic performance. At the same time, the results of this research have provided further evidence of the validity of the lexical hypothesis, as well as establishing a firm basis for viewing personality as an important component of students’ willingness to perform. And, just as with work performance, Conscientiousness has the strongest association with academic performance of all the FFM dimensions and rivaled that of intelligence except in primary education. Yet the complications highlighted by the moderator analyses indicate that the relationship between personality and academic performance needs to be understood as a complex phenomenon in its own right.

Just as with work performance, future considerations of individual differences with respect to academic performance will need to consider not only the *g* factor of intelligence, but also the *w* factor of Conscientiousness. However, the strength of the various moderators examined in this meta-analysis shows that, although it can be stated that personality is related to academic performance, any such statement must be subject to qualifications relating to academic level, age, and the interaction between these variables, and most likely also to range restriction. The degree of heterogeneity identified within the samples indicates that there are likely to be further substantial moderators to be identified. Although the role of personality in academic

performance may be both statistically and practically significant, it is also subtle, complex and in need of much further exploration.

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Table 1

Correlations between FFM scales and Academic Performance

$\rho : 95\%$											
Credibility											
Interval											
FFM Scales	k	N	r^a	ρ^a	d	Grade	Lower	Upper	Q^a	I^2	ρ_g
Diff.											
Agreeableness	109	58522	.07	.07	.14	.10	-.16	.30	921.7	88.3%	.07
Conscientiousness	138	70926	.19	.22	.46	.31	-.09	.54	1990.4	93.1%	.24
Emotional Stability	114	59554	.01	.02	.03	.02	-.29	.32	1563.3	92.8%	.01
Extraversion	113	59986	-.01	-.01	-.02	-.01	-.32	.30	1599.5	93.0%	-.01
Openness	113	60442	.10	.12	.24	.16	.09	.17	1028.4	89.1%	.09
Intelligence	47	31955	.23	.25	.52	.35	-.18	.68	1606.5	97.1%	-

k = number of samples; N = aggregate sample; r = sample-weighted correlation; ρ = sample-weighted correlation corrected for scale reliability; d = Cohen's d ; Grade Diff. = d expressed as grade difference; Q = Cochran's measure of homogeneity; I^2 = Higgins & Thompson's (2002) measure of heterogeneity; $\rho_g = \rho$ as partial correlation, controlled for intelligence.

^a All estimates of r , ρ & Q are significant at $p < .001$

Table 2

Moderation of academic performance-personality correlations by academic level.^{a b}

	<i>k</i>	<i>N</i>	<i>R</i>	<i>R</i> ²	<i>B</i>	S.E. <i>B</i> .	β	ρ	<i>D</i>	Grade	ρ_g
										Diff	
<u>Correlations with Agreeableness</u> ^c											
Total Sample of Studies	107	56628	.461	.212***				.07			
Primary Education (Constant)	8	3196			.298***	.045		.30 _a	.64	.42	.27
Secondary Education	24	25488			-.247***	.047	-1.009	.05 _b	.10	.07	.05
Tertiary Education	75	27944			-.239***	.047	-.979	.06 _b	.12	.08	.06
<u>Correlations with Conscientiousness</u> ^c											
Total Sample of Studies	135	68063	.187	.020				.24			
Primary Education (Constant)	8	3196			.283***	.045		.28 _a	.58	.40	.22
Secondary Education	35	31980			-.077	.048	-.335	.21 _a	.42	.29	.23
Tertiary Education	92	32887			-.041	.047	-.179	.23 _a	.47	.32	.24
<u>Correlations with Emotional Stability</u> ^c											
Total Sample of Studies	112	57658	.400	.160***				.02			
Constant (Primary Education)	8	3196			.242***	.051		.20 _a	.40	.27	.11
Secondary Education	24	25495			-.228***	.054	-.822	.01 _b	.03	.02	-.01
Tertiary Education	80	28967			-.246***	.054	-.893	-.01 _b	-.02	-.01	-.02
<u>Correlations with Extraversion</u> ^c											
Total Sample of Studies	114	58518	.414	.171***				.00			
Primary Education (Constant)	8	3196			.188***	.044		.18 _a	.37	.25	.06
Secondary Education	25	25648			-.217***	.046	-.919	-.03 _b	-.06	-.04	-.03
Tertiary Education	78	28424			-.202***	.046	-.859	-.01 _b	-.03	-.02	-.01
<u>Correlations with Openness</u> ^c											
Total Sample of Studies	110	58739	.385	.148***				.12			
Primary Education (Constant)	8	3196			.260***	.042		.24 _a	.48	.33	.18

Secondary Education	25	25909	-.141**	-.045	-.631	.12 _b	.23	.16	.09
Tertiary Education	77	28471	-.184***	.044	-.827	.07 _c	.15	.10	.04
<u>Correlations with Intelligence</u> ^c									
Total Sample of Studies	47	31955	.470	.221***			.25		
Primary Education (Constant)	4	1791	.567***	.092		.58 _a	1.42	.97	na
Secondary Education	17	12606	-.323**	.099	-.963	.24 _b	.49	.33	na
Tertiary Education	26	17588	-.341***	.097	-1.033	.23 _b	.47	.32	na

k = number of samples; N = aggregate sample; R = multiple R for regression equation; B = regression weight; $S.E.B.$ = standard error of B ; β = standardized regression weight; ρ = sample-weighted correlation corrected for scale reliability; d = Cohen's d ; Grade Diff. = d expressed as grade difference; $\rho_g = \rho$ as partial correlation, controlled for intelligence.

^a Calculated using least squares regression weighted by sample size.

^b Correlations at different academic levels within the same model that do not share the same subscript are significantly different at $p < .05$.

^c The criterion variables for each analysis are the corrected correlations with academic performance.

* $p < .05$; ** $p < .01$; *** $p < .001$.

Table 3

Moderating Effects of Age on Correlations of FFM scales and Academic Performance within Academic Levels.^{a b}

	Total Sample	Primary Education	Secondary Education	Tertiary Education
	Sample Mean Age	Sample Mean Age	Sample Mean Age	Sample Mean Age
Mean	17.21	11.11	16.12	20.43
Standard Deviation	3.77	1.57	2.45	2.79
Correlations of academic performance with: ^c				
Agreeableness	-.38*** (107)	-.54 (8)	-.42* (24)	.17 (75)
Conscientiousness	-.03 (135)	.87** (8)	-.12 (35)	-.07 (92)
Emotional Stability	-.44*** (111)	.77* (8)	-.63*** (24)	-.14 (79)
Extraversion	-.17 (109)	.79* (8)	.10 (24)	.13 (77)
Openness	-.43*** (110)	-.76* (8)	-.47* (25)	.10 (77)

^a Values in brackets refer to the number of studies used to calculate moderator effects.

^b All moderator effects are beta weights, calculated using least squares regression weighted by sample size.

^c The criterion variables for each analysis are the corrected correlations with academic performance.

* $p < .05$; ** $p < .01$; *** $p < .001$.