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Running head: EYSENCKIAN FACTORS AND ACADEMIC
PERFORMANCE

The Eysenckian Personality Factors and their Correlations with Academic
Performance

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Abstract

Background:

The relationship between personality and academic performance has long been explored, and a recent meta-analysis (Poropat, 2009) established that measures of the Five-Factor Model (FFM) dimension of Conscientiousness have similar validity to intelligence measures. Although currently dominant, the FFM is only one of the currently-accepted models of personality, and has limited theoretical support. In contrast, the Eysenckian personality model was developed to assess a specific theoretical model and is still commonly used in educational settings and research.

Aims:

This meta-analysis assessed the validity of the Eysenckian personality measures for predicting academic performance.

Sample:

Statistics were obtained for correlations with Psychoticism, Extraversion and Neuroticism (20 – 23 samples; N from 8,013 to 9,191), with smaller aggregates for the Lie scale (7 samples; N = 3,910).

Methods:

The Hunter-Schmidt (2004) random effects method was used to estimate population correlations between the Eysenckian personality measures and academic performance. Moderating effects were tested using weighted least squares regression.

Results:

Significant but modest validities were reported for each scale. Neuroticism and Extraversion had relationships with academic performance that were consistent with previous findings, while Psychoticism appears to be linked to academic performance because of its association with FFM Conscientiousness. Age and educational level moderated correlations with Neuroticism and Extraversion, and gender had no moderating effect. Correlations varied significantly based on the measurement instrument used.

Conclusions:

The Eysenckian scales do not add to the prediction of academic performance beyond that provided by FFM scales. Several measurement problems afflict the Eysenckian scales, including low to poor internal reliability and complex factor structures. In particular, the measurement and validity problems of Psychoticism mean its continued use in academic settings is unjustified.

Key-words

Eysenck Personality; Academic Performance; Meta-Analysis; Moderation

The Eysenckian Personality Factors and their Correlations with Academic Performance

Both historically and internationally, academic performance has long been one of the most important issues in complex civilizations, ranging from its ancient role in selecting civil servants in the Middle East, India and China to its current significance as a driver of advanced economies (OECD, 2007). Given the association between academic performance and subsequent work performance (Roth, BeVier, Schippman, & Switzer III, 1996) salary (Roth & Clarke, 1998), and career and social success (Strenze, 2007), academic performance is clearly an outcome worthy of attention.

It is not surprising, therefore, that academic performance has long been one of the key phenomena of interest in education and psychology. Some of the earliest modern psychological research was conducted with the purpose of identifying the factors that predict academic performance. For example, early in the twentieth century Binet and Simon conducted much of their early exploration of childhood intelligence at the request of the French government, who were interested in methods of predicting school performance (Becker, 2003). Spearman (1904), on the other hand, used academic performance as the basis for developing his theory and measure of intelligence. Intelligence remains one of the most potent empirical predictors of academic performance (Neisser, et al., 1996; Strenze, 2007) but it is not alone. In particular, a recent large meta-analysis found that the personality dimension of Conscientiousness has correlations with academic performance that are of similar strength to correlations between intelligence and academic performance, at least at tertiary level (Poropat, 2009).

This recent result opens up the possibility of finding further links between personality and academic performance. The Poropat (2009) meta-analysis relied on one of the currently dominant models of personality, namely the Five-Factor Model (FFM). This model, made up of the dimensions of Agreeableness, Conscientiousness, Emotional Stability, Extraversion and Openness to Experience, has held a preeminent position in personality research for some time (Funder, 2001) but is far from being the only currently-accepted model of personality. For example, just like the FFM, six- (Ashton, et al., 2004) and seven-factor (Saucier, 2003) models have been developed on the basis of factor analyses of common-language personality descriptors. In part, the existence of competitors to the FFM is due to the fact that it lacks a compelling theoretical basis for its structure because it was derived empirically rather than as the result of testing theoretical predictions. Deciding between factor structures on empirical grounds involves a degree of arbitrariness (Block, 2001). This arbitrariness makes it more difficult to determine just what correlations with the FFM dimensions may mean.

Not all personality scales have been developed this way; several common personality assessments have been created on explicit theoretical bases (e.g., Carver & White, 1994; Cloninger, Przybeck, Svrakic, & Wetzel, 1994). Of personality assessments with an underlying theoretical basis, one of the most often used is the Eysenck Personality Questionnaire (EPQ: H. J. Eysenck & Eysenck, 1975) and its predecessors, the Eysenck Personality Inventory (EPI: H. J. Eysenck & Eysenck, 1964) and the Maudsley Personality Inventory (MPI: H. J. Eysenck, 1959). Although, Eysenck did use exploratory factor analysis in the development of his model, what distinguishes his work from that leading to the FFM is the fact this model is not purely empirically-based; instead he used theory to guide his factor analyses, arguing

that personality should reflect underlying brain structures. Eysenck's (1947) initial efforts to identify personality factors involved factor-analyses of personality ratings of psychiatric in-patients, resulting in two dimensions: Extraversion and Neuroticism, which were theorized to reflect the reticulo-cortical and reticulo-limbic systems respectively (H. J. Eysenck, 1967; Matthews & Gilliland, 1999). Extraversion was seen as based on an individual's chronic level of reticulo-cortical arousal and hence one's tendency to approach or avoid stimulating environments (Extraversion), while Neuroticism was linked to an individual's reticulo-limbic responsiveness to emotional stimuli and associated affective lability. It should be noted that these two dimensions are closely associated with the FFM dimensions of Extraversion and Emotional Stability (the latter of which is often represented as the arithmetical reverse of Neuroticism), even though the FFM was developed independently and later, and with a methodology that was unguided by comparable theoretical grounding. Subsequent to the initial development of measures for Extraversion and Neuroticism came the addition of a Lie scale (H. J. Eysenck & Eysenck, 1964), initially as a form of validity check on responses but subsequently adopted by researchers as a measure of interest in its own right. Sometimes referred to as Social Conformity (Francis & Montgomery, 1993), the Lie Scale appears to be closely associated with Social Desirability (Barrett, 1999; S. B. G. Eysenck & Chan, 1982; Motl, McAuley, & DiStefano, 2005; Stober, 2001). The final component to be added to the Eysenckian model was the Psychoticism scale (H. J. Eysenck & Eysenck, 1975), hypothesized to reflect the normal population equivalent of a common factor, the extreme of which underlies psychosis. As such, Psychoticism was seen as reflecting behaviors such as hostility, aggressiveness, depressiveness and criminality (H. J. Eysenck, 1992), while its

opposite pole, sometimes referred to as *Tough-Mindedness* (S. B. G. Eysenck & Chan, 1982), encompasses empathy, conformity and conventionality.

Eysenck argued strongly for his model of personality by emphasizing its advantages over the FFM, especially its relatively strong theoretical foundation (H. J. Eysenck, 1993; H. J. Eysenck, 1995). Unfortunately, the Eysenckian model has its own problems, beginning with its psychometric structure. The scales on the EPQ have been criticized for lacking empirical coherence, particularly by repeated claims that each reflects dual underlying constructs. For example, the Extraversion scale has long been questioned as possibly reflecting both sociability and impulsiveness (Carrigan, 1960; Guilford, 1975), while the Lie scale may reflect both faking and social conformity (Francis, Pearson, & Stubbs, 1991). Eysenck himself argued that other personality constructs were subsumed under Psychoticism, for example the FFM dimensions of Agreeableness and Conscientiousness (H. J. Eysenck, 1995), which may account for the relatively poor internal consistency of the scale (Ng, Cooper & Chandler, 1998). Consistent with these points, Roger and Morris (1991) found each of the EPQ scales produced two factors when subjected to further exploratory factor analysis, while Ng et al., (1998) extracted factors from the EPQ items that they argued reflected the FFM. Although neither of these research teams tested the comparative fit of their factors, their results raised concerns with respect to the underlying structure of the EPQ.

Attempts were made by Eysenck and others to address the internal consistency problems with the EPQ by revising its scales, especially the Psychoticism scale (Corulla, 1990; H. J. Eysenck & Eysenck, 1975; S. B. G. Eysenck & Eysenck, 1985). With respect to criticisms about its factor structure, Barrett (1999) provided supporting evidence for the EPQ model based on several relatively large samples of

adults and adolescents. However, he did acknowledge that measures such as the EPQ, which have been developed using exploratory factor analysis, are often heir to structural problems. By way of comparison, FFM measures commonly display poor fit when tested using confirmatory factor analysis (McCrae, Zonderman, Costa, Bond, & Paunonen, 1996). The EPQ studies reported by Roger and Morris, and Ng et al. also used exploratory factor analyses but unguided by a theory that is as coherent as that used for the EPQ. Given the existence of factor analyses that support different underlying structures, researchers can choose on some arbitrary basis (e.g., Kaiser's (1960) eigen-value greater than 1 rule), but it is much wiser to let supporting theory and corroborating evidence help them decide (Block, 2001). So, findings of alternative factor structures among EPQ items may be cause for concern but are not fatal to the Eysenckian model, provided there is independent evidence for their existence.

It is for this reason that, when debating personality structures, Eysenck (1970, 1993; 1995) made much of the independent psychophysiological evidence for the EPQ. The observation that the EPQ scales appear to reflect theoretically-significant socio-cognitive factors (Eysenck, 1995; Matthews & Gilliland, 1999) provides some support for the Eysenckian model. Other evidence has been mixed, with some supporting Eysenck's conceptualization of Extraversion, but little support for his ideas on Neuroticism (Matthews & Gilliland, 1999). This may be due to the right ideas explained in the wrong way because Eysenck had attempted to focus on single systems to explain his constructs even though traits appear to have more complex causation (Matthews, 1997). So, it is not yet possible to provide a definitive evaluation of the EPQ. It was in light of this that the current meta-analysis was conducted as an exploration of the validity of the EPQ within academic settings.

Why should the EPQ be related to academic performance?

There is a long tradition of applying the EPQ and its predecessors to the question of understanding academic performance, with the first studies demonstrating significant relationships between the MPI and educational outcomes (e.g., Callard & Goodfellow, 1962; Savage, 1962) appearing within a few years of the MPI's initial publication (H. J. Eysenck, 1959). The reasons for expecting the various EPQ scales to be associated with academic performance are both varied and complex, and include hypotheses about the moderating effects of age, academic level (primary, secondary or tertiary education) and gender (cf., H. J. Eysenck & Cookson, 1969).

Neuroticism

Neuroticism in part reflects a lower estimation of one's own abilities (Judge & Bono, 2002), and a higher estimation has been observed to positively correlate with academic performance (Robbins, et al., 2004). Neuroticism is also believed to affect students' ability by directing their attention away from study and on to their anxious emotions and self-talk (De Raad & Schouwenburg, 1996), which may also be related to the observation that less-resilient students have lower academic achievement (Hojat, Gonnella, Erdmann, & Vogel, 2003). On the other hand, the more intelligent a student, the less the association between anxiety and performance (Perkins & Corr, 2006; Spielberger, 1962), so one would expect brighter students to have less problems with Neuroticism-associated effects on their studies. To the extent that intelligence is associated with continuing to higher levels of education (Strenze, 2007), one would expect the association between Neuroticism and academic performance to be moderated by academic level. Alternatively, Eysenck and Cookson (H. J. Eysenck & Cookson, 1969) argued that the educational process would amount to 'weeding out those whose N component acted as a hindrance rather than as a motivational variable'

(p. 110). Regardless of the explanation, just such a moderating effect has been observed with respect to Emotional Stability (Poropat, 2009), the FFM factor closely associated with Neuroticism. So, it should be expected that Neuroticism will be negatively correlated with academic performance but that this effect would decrease with academic level.

Extraversion

Extraversion has also been predicted to have a complex association with academic performance but to be predominantly positively correlated with this criterion. For example, Eysenck and Cookson (1969) suggested that extraverted students would do better in early schooling because of their greater levels of interaction, but that introverts would be 'late bloomers' whose levels of concentration would allow them to surpass their extraverted colleagues as they grow older and more mature. The higher energy levels and positive attitude of students high on Extraversion are expected to lead to a desire to learn and understand (De Raad & Schouwenburg, 1996). Yet, more extraverted students are also more likely to be distracted by other activities such as socializing (Eysenck, 1992: cited in De Raad & Schouwenburg, 1996), leading to lower levels of performance. A further complicating effect is that Extraversion makes students more visible to teachers, creating greater opportunities to observe student performance but also to be biased by greater relationship effects (Poropat, 2009). Such effects are likely to diminish with higher levels of education, as student interactions with teachers become increasingly distant at secondary and tertiary levels. These various points, along with the observed relationships between the FFM dimension of Extraversion with academic performance (Poropat, 2009), mean that Extraversion should be expected to be

positively associated with academic performance but this relationship should diminish with age and academic level.

Lie

To the extent that the EPQ Lie scale can be considered to be a measure of social conformity (Francis et al., 1991) it should be associated with compliance with socially-imposed requirements, such as those that exist within educational settings. Consistent with this, low scores on the EPQ Lie scale are linked to teacher-rated student conduct problems such as being restless, disobedient, fidgety and distracted (Slobodskaya, Safronova, & Windle, 2005) and with accepting attitudes to being absent from formal study activities (Jones & Francis, 1995), a behaviour which has a deleterious effect on academic performance (Farsides & Woodfield, 2003). High scores on the Lie scale are correlated with positive attitudes of secondary education students to school generally as well as to individual subjects they are studying (L. J. Francis & A. Montgomery, 1993). Positive attitudes have been linked to involvement in study activities (White, Thomas, Johnston, & Hyde, 2008), which together with any reduction in truancy should, in turn, affect educational outcomes. Consequently, there are a range of reasons for expecting to find a link between Lie scale scores and subsequent academic performance.

Psychoticism

The last-developed of the EPQ scales, Psychoticism has been associated with the FFM dimensions of Agreeableness and Conscientiousness (H. J. Eysenck, 1993), but it is its links to the latter dimension that are particularly pertinent in an educational context. This is because among the FFM dimensions, Conscientiousness is the most closely associated with academic performance, with correlations that rival those of

intelligence with academic performance (Poropat, 2009). So the fact that Psychoticism has been found to have substantial correlations with Conscientiousness (-.53: Patrick C. L. Heaven, Ciarrochi, & Vialle, 2007) suggests the possibility of shared associations with academic performance. Other supporting evidence comes from the fact that, just as with low scores on the Lie scale, students with high scores on the Psychoticism scale tend to think there is nothing wrong with truancy (Jones & Francis, 1995) and to have negative attitudes to school and school-work (L. J. Francis & A. Montgomery, 1993). Likewise, high-scorers on Psychoticism have more difficulties at school (Sloboskaya, et al., 1995). Taken together, it is reasonable to think that Psychoticism may well be linked to academic performance.

Moderators

As discussed above, both age and academic level have been proposed as moderators of correlations between EPQ scales and academic performance, which is consistent with the fact that both of these factors were found to be significant moderators in the largest ever meta-analysis of research in this area (Poropat, 2009). However, Eysenck and his colleagues also long argued that gender may affect the predictive validity of the EPQ scales (e.g., H. J. Eysenck & Cookson, 1969; S. B. G. Eysenck & Chan, 1982), so this should also be considered. A further potential moderator is the measures of the Eysenckian scales that were used in each study. Ng et al. (1998) presented evidence that these scales are not directly comparable across different versions. Although Barrett (1999) provided a thorough critique of Ng et al.'s (1998) analyses and conclusions, the question remains as to whether different versions reflect precisely the same variance between students. Accordingly, the moderators that were tested in this study were age, educational level, gender and measurement instrument.

In summary, there are theoretical and empirical reasons for proposing that each dimension of the Eysenckian model of personality is associated with academic performance. Neuroticism and Psychoticism should be negatively correlated while Extraversion and the Lie scale should be positively correlated with academic performance. Moreover, these correlations are likely to be affected by moderating factors, namely age, educational level, gender and measurement instrument. Consequently, the research questions that guided this meta-analysis were:

What is the relationship between academic performance and the Eysenckian scales?

What moderators affect the strength of these various relationships?

Method

Sample

The studies that formed the database for this meta-analysis were located by searching the ISI Web of Science, PsycINFO, and ProQuest Dissertations and Theses databases. The same terms and Boolean operators were used as were used in the Poropat (2009) study, namely: (academic OR education OR university OR school) AND (grade OR GPA OR performance OR achievement) AND (personality OR temperament). However, the additional search term *Eysenck* was added to focus the search upon studies that used Eysenckian scales. Two of the most popular Eysenckian assessments underwent significant revisions in 1985 (EPQ: S. B. G. Eysenck, Eysenck, & Barrett, 1985) and 1990 (Junior Eysenck Personality Inventory (JEPI): Corulla, 1990), so the search was limited to studies completed after 1990. The abstracts of the studies were first reviewed, then if they appeared to contain relevant data the full article, dissertation or paper was retrieved and relevant data extracted, if

available. This yielded a total of 23 samples each for correlations with Extraversion and Neuroticism, 20 samples for correlations with Psychoticism, and 7 samples for correlations with the Lie scale. Cumulative sample size ranged from 3,910 for correlations with the Lie scale to 9,191 for correlations with Extraversion. The studies used as the basis for this meta-analysis are indicated in the reference list to this article by a leading asterisk.

Coding

Many of the studies in the meta-analytic sample reported correlations with multiple measures of academic performance. Where each of these measures came from a similar level of assessment aggregation (e.g., all were single assessments, single courses, or grade point average (GPA) for a single year) the average of the resulting correlations with individual personality scales was used (e.g., Furnham & Mitchell, 1991). If correlations were reported with academic performance measures from different levels of aggregation (e.g., single courses versus GPA), the correlation with the higher level of assessment aggregation was used (e.g., Furnham & Medhurst, 1995).

Many studies reported statistics other than correlations. For example, some studies split participants into groups according to their personality or academic performance scores and then reported t-tests (e.g., Wan, et al., 2003; Wang, Huang, Zhang, & al., 2008), F-tests (e.g., DeBates, 1999; Fenderson, Hojat, Damjanov, & Rubin, 1999) or χ^2 (Zhang & Qian, 1995). In such cases, the statistic was converted to an equivalent *r*-value using standard equations (Hunter & Schmidt, 2004) prior to inclusion within the meta-analytic data-base. In one case, mean scores and standard deviations were reported, which allowed the calculation of a t-test prior to conversion to *r* (Mwamwenda, 1995). In one case (Yan-Ling, Hai-Yan, & Hong-Bing, 2005),

only beta-weights were reported, so these were used instead of correlations, in line with Hunter and Schmidt's (2004) recommendations. In some cases, authors did not report enough data to enable me to construct an estimate of correlations (e.g., Aluja-Fabregat, Balleste-Almacellas, & Torrubia-Beltri, 1999; Beaulieu, 1991; Cassidy & Lynn, 1991; Gallagher, 1996; Kundu & Basu, 1991; Wills, 1996). One article reported on an experiment that used the EPQ (Farrell, 1997) so the results were not directly comparable with those of the rest of the meta-analysis, hence the study was excluded. Other studies were excluded because they either commented on the relationships between Eysenckian personality dimensions and academic performance in their abstract, but did not report them in their article (Chamorro-Premuzic & Furnham, 2002) or because the same data was used in two separate publications that nonetheless used different analyses and answered different research questions (Petrides, Chamorro-Premuzic, Frederickson, & Furnham, 2005; Petrides, Frederickson, & Furnham, 2004). Finally, in one case I was unable to obtain a translation of an article before undertaking the analysis (Vitinova, 1992) but the omission of this one study, with a sample of 410, is unlikely to have had a major impact on the final estimates.

The average age of the sample was used as the predictor variable in tests of the moderating effect of age. Where sample average age was not directly reported, an estimate was obtained by computing the average age for samples of students at similar year level (e.g., 1st year of university or year 10 in secondary school).

Corrections

Estimates of Cronbach's (1949) alpha were used to correct reported correlations for scale reliability. However, many studies did not report alpha or any other measure

of internal reliability or consistency. In such cases, estimates based on the results reported by S. B. G. Eysenck and Chan (1982) for the Chinese-language version of the EPQ (sample-weighted average alpha – Psychoticism: .61; Extraversion: .80; Neuroticism: .83; Lie Scale: .68), or from Barrett (1999) for the JEPQ (alpha – Psychoticism: .71; Extraversion: .72; Neuroticism: .83; Lie Scale: .85), or the EPQ-R (alpha – Psychoticism: .72; Extraversion: .85; Neuroticism: .86; Lie Scale: .81), were used where relevant. Only a few studies reported estimates of alpha for academic performance (Di Fabio & Palazzeschi, 2009; Heaven, Mak, Barry, & Ciarrochi, 2002; Heaven & Newbury, 2004; Mak, Heaven, & Rummery, 2003). In other cases, the most appropriate estimate of alpha reported by Bacon and Bean (Bacon & Bean, 2006) was used. It should also be noted that several studies used self-reported academic performance (Heaven, et al., 2002; Heaven & Newbury, 2004; Mak, et al., 2003). Although not ideal, self-reported GPA is usually quite reliable and valid (Kuncel, Crede, & Thomas, 2005).

With respect to range restriction, approximately one-third of studies reported standard deviations for the personality variables, while approximately one-quarter reported standard deviations for the academic performance measures. Combined with the fact that most if not all of the personality scales used in these studies have not been standardized on samples that are representative of the broader population, this means that there was no reliable basis on which to calculate estimates and hence corrections for range restriction. Thus, the reported meta-analytic values are likely to under-estimate the true relationships. It would be helpful if future researchers took more care in obtaining and reporting these statistics.

Results

Given the importance of scale reliability generally and for the history of the Eysenckian measures in particular, the internal reliabilities (Cronbach's alphas) for the personality measures were examined first. Among the articles that were included in the meta-analysis, roughly half reported estimates of alpha (Psychoticism: $k = 12$; Extraversion: $k = 12$; Neuroticism: $k = 11$; Lie Scale: $k = 3$). Using Ponterotto and Ruckdeschel's (2007) cut-offs for alpha values for scales of over 12 items using samples of greater than 300, the alpha for Neuroticism ($\alpha = .84$; $N = 2981$) had only 'fair' internal reliability, while the corresponding values for Extraversion ($\alpha = .79$; $N = 3028$) and the Lie scale ($\alpha = .76$; $N = 833$) were slightly below the cut-off value of .80. The internal reliability of the Psychoticism scale ($\alpha = .69$; $N = 3704$) remains a serious concern despite its revisions.

The initial meta-analysis was conducted using Hunter and Schmidt's (2004) random effects method, and included all correlations between academic performance and each of the Eysenckian scales. The results of these analyses are reported in Table 1. It can be seen from these results that correlations of academic performance with each of the Eysenckian scales had 95% confidence intervals that do not include zero, which means that in normal terms they each can be considered statistically significant. As expected, Extraversion and the Lie scale had positive correlations, and Psychoticism and Neuroticism had negative correlations with academic performance. However, the magnitudes of the corrected correlations with Extraversion and the Lie scales are minor, whilst the corrected correlations with Psychoticism and Neuroticism are relatively modest in comparison with the corresponding estimate for Conscientiousness ($\rho = .22$) reported by Poropat (2009).

Insert Table 1 around here

The credibility intervals for each of these estimates are substantial. Combined with the highly significant Q values for each estimate, this indicates the presence of systematic differences between the various samples that the overall estimate was based upon. Higgins and Thompson's (2002) I^2 allows an estimate of the relative proportion of systematic variation between samples. It is clear from the magnitude of I^2 that substantial systematic variation exists between the various samples, warranting the search for moderators.

To test for moderators, weighted least squares regression was used because this method tends to be the most accurate (Steel & Kammeyer-Mueller, 2002). This involved regressing the corrected correlations against the predicted moderators, using the original sample size to weight the data. Age, educational level, and the interaction between age and educational level were tested as moderators in the Poropat (2009) meta-analysis of the FFM and academic performance, and those analyses are repeated here. In addition, the moderating effects of gender and personality measurement instrument were tested.

Age was found to have a direct moderating effect on correlations between academic performance and Neuroticism (Beta = .46, $p < .05$), with higher age being associated with weaker correlations. Consistent with Poropat (2009), educational level was dummy coded. Educational level was found to have a direct moderating effect on correlations between Neuroticism and academic performance, with tertiary level correlations with Neuroticism ($\rho = .00$) being significantly lower (Beta = .42, $p < .05$) than those for primary ($\rho = -.14$) or secondary level ($\rho = -.10$). There was no

significant difference between primary and secondary level correlations. This is slightly different to the pattern observed by Poropat (2009) for correlations between academic performance and Emotional Stability, for which there was a significant difference between correlations at primary level with correlations at both secondary and tertiary levels, but no difference between correlations at secondary and tertiary levels. However, in the current study the sample-weighted average ages for primary (12.6 years) and secondary level (15.2 years) were much closer than the corresponding average ages in the Poropat (2009) study (11.1 versus 16.6 years). Given that age was a significant moderator of correlations with Neuroticism and Emotional Stability, this appears to account for the difference in moderating effect of educational level between the two meta-analyses.

Educational level also moderated correlations between academic performance and Extraversion, with correlations at primary level (.10) being significantly higher (Beta = .51, $p < .05$) than correlations at secondary (.02) and tertiary levels (.01). There was no significant difference between correlations at secondary and tertiary levels. This pattern accords closely with the pattern observed by Poropat (2009) for correlations with the FFM Extraversion dimension.

No moderating effects were found for age or educational level on correlations between academic performance and either Psychoticism or the Lie scale. With respect to Psychoticism, this is consistent with its association with academic performance being due to their common links with Conscientiousness, because Poropat (2009) found no moderating effect for age or educational level on correlations between academic performance and Conscientiousness. Poropat (2009) did, however, report that the interaction between age and educational level moderated correlations of Conscientiousness with academic performance, but that meta-analysis included

samples that were considerably younger than the youngest samples reported for correlations with Psychoticism in the present study (8.3 versus 12.0 years). With respect to the Lie scale, it was extremely unlikely to find any moderating effect given only seven samples were obtained for inclusion in the analysis. Consistent with Poropat (2009), the interaction between age and educational level was examined by testing the effect of age within each educational level. No moderating effects for this interaction were observed. Although, once more the restricted number of samples probably precluded the finding of moderation due to the interaction, the average age of the samples is also relevant. In the Poropat (2009) study, the strongest effects of the interaction of age and educational level occurred within the primary level, but the samples in this meta-analysis did not have nearly as much variance as those in the earlier study.

The moderating effect of gender was tested by using the percentage of females in the various samples as the predicting variable. No moderating effects were found for gender with correlations with any of the Eysenckian scales overall or at any educational level, which is inconsistent with expectations. In order to check for moderating effects due to the measurement instrument used in each study, studies were dummy coded for each measurement instrument in the weighted least squares regression analysis. The specific scales that were examined were: the EPQ and EPQ-R; the junior versions of the EPQ, including the Corulla scale; the Chinese language version of the EPQ; and the Russian language version of the EPQ. Moderating effects were tested among the entire meta-analytic database for each scale and also among the reported correlations for pre-tertiary samples, because there were almost no cases of studies at tertiary level that used a scale apart from the EPQ-R. The only significant moderating effect due to the measurement instrument was on correlations between

Neuroticism and academic performance. In this case, at pre-tertiary level correlations were significantly lower (i.e., further from zero) when either the Chinese language versions (Beta = $-.78$, $p < .05$) or the junior versions (Beta = -1.18 , $p < .001$) were used.

Discussion

This meta-analysis has provided the first comprehensive empirical review of the validity of the Eysenckian personality scales as statistical predictors of academic performance. As expected, academic performance was significantly associated with Neuroticism and Psychoticism, and the correlations with Neuroticism fell with age and increasing academic level. When looking at the overall sample, correlations with Extraversion may have been significant in a statistical sense but their practical significance is minimal except at primary level. The drop in correlations with Extraversion from primary to secondary level is consistent with Eysenck and Cookson's (1969) arguments but, contrary to their predictions, the association with Extraversion does not signify that introverted students are late-bloomers — there is no reversal in the sign of the correlation, just its decline. Correlations of academic performance with the Lie scale are significant but very modest in the total sample, with no significant moderating effects found. Interestingly, no moderating effects for gender were observed, despite the expectations of Eysenck and his colleagues.

Where similar scales were used, the findings of the current meta-analysis were largely consistent with those of Poropat's (2009) meta-analysis that was based on the FFM. The findings for Neuroticism were similar to those for Emotional Stability (albeit with the sign of the correlations reversed) and Extraversion showed similar strength, whether measured as part of the Eysenck or FFM approaches. Similar moderating effects were also found in both meta-analyses, except that no interaction

between age and educational level was observed. However, this may be an artifact of the relative numbers of samples in the two meta-analyses and of their average sample age.

What this means is that researchers and educationalists can have some confidence that both Extraversion and Neuroticism are most important as predictors of educational outcomes in primary education, but that these associations evaporate away to minimal levels at secondary and tertiary education. This probably reflects both the changing relationship between teachers and students and the validity of measurement of academic performance at the different educational levels. At primary level, teachers have much closer contact with their students, so personality factors that affect the quality of relationships are also more likely to affect assessment of performance by teachers. Extraverted students are more likely to be noticed and receive attention from teachers because of their outgoing, interactive nature. Those who get attended to, get assisted, and those who get noticed, get remembered, both of which in turn positively affect performance ratings (Murphy & Cleveland, 1995). Neuroticism is negatively associated with social desirability (Digman, 1997), which also affects ratings of performance (Felson, 1980; Zahr, 1985). At higher levels of education, the relationship between teachers and students becomes more distant so the social effects of Extraversion and Neuroticism on performance ratings would weaken. By this account, the introverted, anxious students are not Eysenck and Cookson's (1969) late bloomers; instead, the emotionally-stable extraverts can no longer rely on their charm to get good grades.

There are, however, other possible explanations for the decline in correlations with Neuroticism. As noted in the Introduction, it may be that poor-performing anxious students are being 'weeded out' by the educational process (H. J. Eysenck &

Cookson, 1969). Alternatively, the 'weeding out' may be based on students' intelligence, and more intelligent students are able to handle their chronic levels of anxiety well enough for there to be no detriment to their performance (Perkins & Corr, 2006; Spielberger, 1962). These different explanations have important and diverging practical implications. If the decline in the strength of correlations with Neuroticism is due to more even-handed dealing by teachers, then teacher-training is called for; if it is due to elimination of the anxious from our schools, then anxiety-management may be appropriate; if it is a consequence of levels of ability, then it may be inappropriate to intervene. Unfortunately, the results of this meta-analysis are not sufficient to decide which of these explanations is the most accurate. Future research, both on the underlying processes and on practical interventions, would be valuable.

The Eysenckian Lie scale had a significant association with academic performance but at a level (.02) that is reminiscent of warnings that everything is correlated with everything else at some 'crud level' (Meehl, 1990). In contrast with the Extraversion and Neuroticism scales, the Lie scale was not found to be moderated by age or academic level. This does not mean that the Lie scale can be dismissed from consideration within educational settings: the proportion of systematic variance in the sample estimates indicates that in some circumstances, the Lie scale may well be relevant. However, this meta-analysis did not demonstrate when this might be.

Psychoticism had a stronger though still modest association with academic performance. This association was consistent with the idea put forward in the Introduction, that the association of Psychoticism with academic performance is entirely due to the fact that Psychoticism is strongly correlated with Conscientiousness, the FFM dimension that is most strongly related to academic performance. Further evidence for this idea comes from the fact that correlations with

Psychoticism had the same pattern of moderation by age and educational level as has been observed for correlations of Conscientiousness with academic performance (Poropat, 2009). Further research may help to clarify this set of relationships.

In summary, it appears that the Eysenckian scales have some modest validity as statistical predictors of academic performance, and that much of the association is moderated by other factors. Educational level and age do moderate associations of Extraversion or Neuroticism with academic performance but the reported values of I^2 indicate that much more research on moderators is needed before these relationships are truly understood. At the same time, the correlations obtained in this meta-analysis appear to mirror those obtained for the relationships between the FFM dimensions and academic performance. This indicates that with respect to academic performance, the validity of scales based on Eysenck's model is accounted for by the validity of scales based on the FFM, despite their disparate genesis.

In other words, the Eysenckian scales are valid, albeit modest statistical predictors of academic performance, but they appear to not add to the understanding of academic performance beyond that provided by the FFM. This is because the observed associations between academic performance with the Eysenckian scales was either matched or surpassed by comparable associations with FFM dimensions. Consistent with this, if the validity of the Eysenckian scales were summed, they would account for substantially less variance in academic performance than does Conscientiousness. Further, the FFM dimensions of Agreeableness and Openness to Experience have similar or stronger validities to those of the Eysenckian scales but are not reflected in the Eysenckian model. In other words, researchers who are interested in exploring the relationships between personality and academic performance would do well to work with the FFM in preference to the EPQ.

Apart from the comparatively modest validities of the Eysenckian scales that are reported here, a further problem is that the Psychoticism scale still has surprisingly poor internal reliability, as assessed by Cronbach's (1949) alpha, despite the efforts to improve this (Corulla, 1990; H. J. Eysenck & Eysenck, 1975; S. B. G. Eysenck & Eysenck, 1985). Among the articles within this meta-analysis that reported alpha for Psychoticism, the sample-weighted average was .69, a figure only slightly lower than those reported by Barrett (1999: .71 and .72). Although it is commonplace to read authors claiming an alpha of .70 as satisfactory, citing Nunnally (1978) in support of this, Nunnally actually wrote that .70 was a modest level but may suffice in the early stages of research. Research on Psychoticism can by no means be considered to be in its early stages. Furthermore, scale length affects alpha (Lance, Butts, & Michels, 2006), so the fact that Psychoticism scales have around twenty items makes their internal consistencies look comparatively poor (Ponterotto & Ruckdeschel, 2007), especially beside FFM scales like the Mini-Markers (Saucier, 1994), which have only eight items each but higher alphas. There may be independent reasons for continuing its use and development in other settings (Hans J. Eysenck, 1995) but these do not overcome the problems with the Psychoticism scale outlined here. In its current form, the Psychoticism scale is unsatisfactory and its continued use in research on academic performance is unjustified.

Other concerns are raised by the significant moderating effect associated with the measures used to assess Eysenckian Neuroticism. The meaning of this moderating effect is unclear because it may be due to the measures themselves or to variations in approaches to educational assessment and practice. For example, the Chinese-language version of the EPQ was, unsurprisingly, only used in Chinese educational settings, so the moderating effect associated with this measure may be due to

differences in scale psychometrics or to differences between educational practices in China and those used elsewhere. So, care should be taken in extrapolating between research conducted using the Chinese-language version or the Junior version of the Eysenckian scales and research conducted with other versions. However, this problem of extrapolating between results obtained using different measures may not be unique to the Eysenckian scales – the Poropat (2009) meta-analysis was based on studies that used around twenty different assessments, including scales with diverse formats. The fact that Poropat did not test the moderating effect of using different scales leaves the question open. Given the findings of this study, this issue clearly needs further consideration.

In conclusion, this meta-analysis has confirmed the validity of personality as a contributing factor to academic performance. Although the findings of this meta-analysis were more modest than those reported in Poropat (2009), they are consistent with the earlier meta-analysis, which gives greater confidence in the role of personality in educational settings. This study has also shown the Eysenckian scales have some validity as statistical predictors of academic performance, but this validity either mirrors, is accounted for, or surpassed by the validity of FFM measures. On the basis of the evidence that is summarised here, there is nothing for researchers interested in academic performance to gain by using the EPQ in preference to FFM measures, and much to be lost. Of course, this cannot be considered a final and definitive evaluation because there is still far too much in the way of systematic variation in results that has yet to be explained. Further, the fact that most of the correlations reported here relied on summary measures of academic performance such as GPA means that much complexity was hidden (See Poropat (2009) for further

discussion of this issue). The door is not closed on the use of the EPQ in the educational context but it can be considered to be no more than slightly ajar.

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Table 1

Meta-analysis of correlations between Eysenck scales and academic performance.

Eysenck Scales	<i>k</i>	<i>N</i>	<i>r</i>	ρ	$\rho : 95\%$		$\rho : 95\%$		<i>Q</i> ^a	<i>I</i> ²
					Confidence		Credibility			
					Interval		Interval			
Lower	Upper	Lower	Upper							
Psychoticism	20	8013	-.06	-.07	-.08	-.06	-.25	.12	91.2	79.2%
Extraversion	23	9191	.02	.03	.02	.04	-.13	.18	81.7	73.1%
Neuroticism	23	9167	-.06	-.09	-.10	-.08	-.26	.08	89.6	83.6%
Lie	7	3910	.02	.02	.01	.04	-.05	.09	11.8	49.1%

k = number of samples; *N* = aggregate sample; *r* = sample-weighted correlation; ρ = sample-weighted correlation corrected for scale reliability; *Q* = Cochran's (1954) measure of homogeneity; *I*² = Higgins & Thompson's (2002) measure of heterogeneity.

^a All estimates of *Q* are significant at $p < .001$.