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Personality, cognitive ability, and beliefs about intelligence as predictors of academic performance

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Abstract

The relationship between the Big Five personality traits, cognitive ability, and beliefs about intelligence (BAI) was explored in a longitudinal study using a sample ($N=93$) of British university students. These three sets of variables were used to predict academic performance (AP) (i.e., examination grades) as well as seminar performance (i.e., behaviour in class, essay marks, and attendance record) aggregated over a 2-year period. Correlational analyses showed that personality (but not intelligence) was related to BAI (specifically entity vs. incremental beliefs): More conscientious participants were more likely to think that intelligence can be increased throughout the life span, whilst low conscientious individuals were more likely to believe that intelligence is stable. However, these beliefs were not themselves significantly related to AP; only personality traits (Conscientiousness positively, Extraversion negatively) and gender were significantly correlated with AP. Further, following a series of hierarchical regression, it was shown that the Big Five personality traits are better predictors of AP than cognitive ability, BAI, and gender. When seminar performance indicators were regressed onto these variables, a similar pattern was obtained: Personality was the most powerful predictor of absenteeism, essay marks, and behaviour in seminar classes (as rated by different tutors), with Conscientiousness being the most significant predictor. Implications for the prediction of academic success in university and the selection of student settings are discussed.

Keywords: Personality; Big Five; Intelligence; Academic performance; Exam marks

1. Introduction

A longstanding central issue for the educational and differential psychologist is the prediction of academic performance (AP) (e.g., Binet, 1903; Busato, Prins, Elshout & Hamaker, 2000; Ebbinghaus,

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1897; Goh & Moore, 1987; Harris, 1940; Savage, 1962; Terman, 1916; Willingham, 1974). This issue has prompted the design and development of psychometric intelligence tests and, more specifically, cognitive ability tests (see Cronbach, 1949; Robinson, 1999). As a consequence, the prediction of AP has been largely associated with the construct and measurement of a person's intelligence.

Although there is an extensive body of research in support of the inclusion of psychometric intelligence tests in the prediction of AP (e.g., Brody, 2000; Gottfredson, 2002, 2003; Jensen, 1980; Kuncel, Hezlett, & Ones, 2001; Wolf, 1972; Zeidner & Matthews, 2000), recent research has suggested that personality inventories may be equally effective in predicting AP, particularly at higher levels of formal education (Chamorro-Premuzic & Furnham, 2003a). Further, there is a considerable amount of research suggesting that, particularly in university settings, the relation between psychometric intelligence and AP may be weaker than expected, and is often not significant (e.g., Mehta & Kumar, 1985; Sanders, Osborne, & Greene, 1955; Seth & Pratap, 1971; Singh & Varma, 1995; Thompson, 1934), both because of the highly restrictive range of intelligence in the students and the increase in continuous assessment over exams. It thus seems likely that, whilst the predictive power of cognitive ability measures tends to decline at higher levels of formal education, the accuracy of personality inventories tends to increase (see Ackerman, 1994; Wolf, 1972).

Several recent studies have replicated the predictive power of personality traits in this type of educational environments:

Chamorro-Premuzic and Furnham (2003a) examined the relationship between personality traits (Costa & McCrae, 1992; Eysenck & Eysenck, 1985) and AP in two samples of British university students. Results indicated that personality scores assessed during the first weeks of the academic year were significantly related to final examination results and course work assessed *three* years later. Furthermore, when the predictability of personality inventories were related to academic behaviour (e.g., attendance record, participation in class, essay production) and teacher's predictions, personality traits were shown to account for additional unique variance (between 10% and 17%) in AP. Particularly, the trait of Conscientiousness as measured by the NEO-FFI and Psychoticism as measured by the EPQ-R (but also Neuroticism and Extraversion) were found to be significant predictors of AP. The authors suggested that well-established personality traits such as those assessing the Big Five and the Gigantic Three should be employed in the prediction of academic success and failure in university programs.

In a similar, but larger, study, the relationship between AP and personality traits was examined not only at the super-trait, but also at the primary trait level (Chamorro-Premuzic & Furnham, 2003b). At the super-trait level, results replicated the significant correlations of AP with Conscientiousness (positively), Extraversion (negatively), and Neuroticism (negatively)(Chamorro-Premuzic & Furnham, 2003). Again, the Big Five accounted for approximately 15% of the variance in university examination grades. At the primary trait level, dutifulness (positively), achievement striving (positively), anxiety (negatively), and activity (negatively) were consistently and significantly related to AP. Furthermore, these subfacets of personality were found to explain almost 30% of the variance in examination grades. However, the authors noted that five major superfactors, rather than thirty minor primary factors, are more robust and reliable to predict AP. Again, it was concluded that personality inventories may represent an important contribution to the prediction of academic success and failure in university (particularly in highly selective and competitive settings).

Although earlier studies have replicated the significant associations of AP with Neuroticism (Cattell & Kline, 1977; De Barbenza & Montoya, 1974; Furnham & Medhurst, 1995; Furnham & Mitchell,

1991; Rindermann & Neubauer, 2001), Extraversion (Entwistle & Entwistle, 1970; Eysenck & Cookson, 1969; Sanchez-Marin, Rejano-Infante, & Rodriguez-Troyano, 2001), and Conscientiousness (Blickle, 1996; Busato, Prins, Elshout, & Hamaker, 1999; Costa & McCrae, 1992; De Raad, 1996; De Raad & Schouwenburg, 1996; Goff & Ackerman, 1992; Kling, 2001), it is important to provide a theoretical explanation for the processes that explain these associations.

The relationship between AP and Neuroticism has been mainly explained in terms of anxiety, particularly under stressful conditions such as university examinations (Hembree, 1988; Siepp, 1991). Furthermore, it has been noted that Neuroticism may also impair performance on psychometric intelligence tests (Zeidner & Matthews, 2000). Boyle (1983) observed that the correlation between AP and psychometric intelligence drops from r=.35 under neutral conditions to r=.21 under stressful conditions. Chamorro-Premuzic and Furnham (2002) also showed that neurotic students were more likely to be absent in examinations due to medical illness or to request and require "special treatment." Thus, Neuroticism may be associated not only with impaired examination performance but also with lower levels of attendance and even negative physical consequences such as racing heart, perspiration, gastric disturbances, and muscle tension (Matthews, Davies, Westerman, & Stammers, 2000). Moreover, it has been shown that Neuroticism is related to poor self-concept (Well & Matthews, 1994) and low self-estimated intelligence (Furnham, Chamorro-Premuzic, & Moutafi, 2003). Since experiencing of stressful situations is, to a great extent, dependent on an individual's perception and appraisal of his/her capabilities to cope with that situation (Lazarus & Folkman, 1984; Seyle, 1976), it is likely that low self-concept and self-estimated intelligence may partly determine the increase of anxiety in neurotic individuals.

With regard to the relationship between AP and Extraversion, the literature seems to indicate that several variables such as age, level of education, and type of assessment may play a crucial role and even determine the nature (i.e., positive or negative) of this correlation. Accordingly, the correlation between AP and Extraversion has been found to change from positive in primary school to negative in secondary school and university (see Entwistle, 1972; Eysenck & Cookson, 1969; Petrides, Chamorro-Premuzic, Fredrickson, & Furnham, in press). This change has been attributed to the change from the sociable, less competitive, atmosphere of primary school to the rather formal atmosphere of secondary school (although others, such as Anthony, 1973, have argued that this change is due to the fact that the less-able individuals become extraverted, and vice versa). In an early version of the EPI Junior, Eysenck (1965) also specified gender difference for this change, namely 14 for females and 15 for males. Further, it is likely that introverts have an advantage in written assessments, whereas extraverts would benefit from oral examinations (Chamorro-Premuzic & Furnham, 2003a; Furnham & Medhurst, 1995; Robinson, Gabriel, & Katchan, 1993). Despite the complex interaction between Extraversion, age, gender, and assessment methods, it is generally accepted that introverts may have an advantage over extraverts with respect to the ability to consolidate learning, as well as lower distractibility and better study habits (Entwistle & Entwistle, 1970; Eysenck & Cookson, 1969; Sanchez-Marin et al., 2001). It would appear that introverts condition faster and have slower decay of their conditioned behaviour. Accordingly, it can be expected that, in university samples and with other salient factors controlled for, introverts will tend to outperform extraverts. This is also consistent with the findings of Rolfhus and Ackerman (1999) who reported negative correlations between Extraversion and several knowledge tests, and suggested that these correlations may be a consequence of differences in knowledge acquisition time between introverts (spend more time studying) and extraverts (spend more time socialising).

The relationship between Conscientiousness and AP seems more straightforward. Researchers have shown that this association is present in school (Wolfe & Johnson, 1995), undergraduate (Busato et al., 1999; Goff & Ackerman, 1992), and postgraduate (Hirschberg & Itkin, 1978; Rothstein, Paunonen, Rush, & King, 1994) levels of education. Further, Conscientiousness appears to be a consistent predictor of occupational performance throughout a variety of settings (Barrick & Mount, 1991, 1993; Matthews, 1997). These results are not surprising since Conscientiousness has been linked to "strength of character" (Smith, 1969), motivation (Andersson & Keith, 1997; Boekaerts, 1996; Furnham, 1995; Pelechano, 1972), and several performance-related traits that are directly assessed by the scale, such as achievement striving, dutifulness, order and responsibility (Chamorro-Premuzic & Furnham, 2003a; De Raad & Schouwenburg, 1996). It has been therefore suggested that Conscientiousness is closely related to motivation and that this personality trait is a significant predictor of performance, particularly when extrinsic determinants of motivation are held constant (Barrick, Mount, & Strauss, 1993; Sackett, Gruys, & Ellingson, 1998). Thus, careful, organised, hardworking, persevering, and achievement-oriented students may expected to succeed in academic settings, particularly when assessed by course work exercises. Interestingly, this type of students may also have lower intellectual ability (Furnham et al., 2003; Moutafi, Furnham, & Crump, 2003; Moutafi, Furnham, & Patiel, in preparation). It has been suggested that individuals develop or increase their Conscientiousness in competitive academic settings to compensate for the relatively lower fluid intelligence, although this theory remains speculation. This may suggest that Conscientiousness is a better predictor of AP than psychometric intelligence.

Much of the current interest in personality and AP is due to Ackerman et al.'s (Ackerman, 1996, 1999; Ackerman & Beier, 2003; Ackerman & Heggestad, 1997) recovery of the work by Snow. In his dissertation, Snow (1992, 1995) suggested that personal variables, such as abilities, attitudes, personality traits, and prior knowledge, interact to affect learning and AP. Snow was particularly interested in identifying which aspects and levels of these personal variables would result in the best combination for achieving efficient learning. Hence, the author concluded that nonanxious learners with low IQ, and able learners who are highly anxious are equally handicapped in academic settings. However, it was not until the work of Ackerman that systematic and robust research begun to explore the possible combinations (i.e., trait complexes) of cognitive and noncognitive traits for the prediction of learning and knowledge acquisition (Ackerman & Beier, 2002).

In general terms, the relationship between AP and personality traits has been thoroughly described by Ackerman et al. (Ackerman, 1999; Ackerman & Beier, 2003; Ackerman & Heggestad, 1997; Goff & Ackerman, 1992). The authors have aimed at developing a conceptual framework to understand the interactions between cognitive and noncognitive individual differences underlying the acquisition of adult knowledge (see also Snow, 1992, 1995). Empirical support for this theory has been provided by the psychometric identification of four main *trait complexes*, one of which (i.e., intellectual/cultural) comprises a mix of both personality and intelligence characteristics. The other three trait complexes have been usually referred to as social, clerical/conventional, and science/mathematical (Ackerman & Heggestad, 1997). It has been argued that trait complexes may have a joint impact on the development of adult intellectual competence, therefore determining individual differences in learning and knowledge. Ultimately, AP can be best understood as a result of the interactions between personality, processes (fluid reasoning ability), knowledge, and interests (PPKI) (Ackerman, 1996) with the environment.

Another variable that has been claimed to have a significant impact on AP is beliefs (or theories) about intelligence (BAI), particularly the question of whether intelligence may or may not increase

throughout the life span, mainly as a consequence of hard work. Although the predictive power of BAI may be considerably lower than the one by psychometric intelligence, several related concepts have emphasised the subjective determinants underlying AP. This phenomenon is usually referred to as expectancy effect, and has been the underlying issue of a variety of research lines, such as self-monitoring (Stankov, 2000), self-handicap (Rhodewalt, 1990), self-evaluation (Flett, Hewitt, Blanckstein, & Gray, 1998; Morris & Liebert, 1969), self-motivation (Zeidner, 1995), self-efficacy (Bandura, 1986; Matthews, 1999), self-concept (Rinderman & Neubauer, 2001), self-esteem, and self-confidence (Koivula, Hassmen, & Fallby, 2002).

Although all these variables seem to indicate that subjective beliefs need not to be accurate in order to affect AP, there are conflicting hypotheses about the direction of this effect. Whereas some have identified and explained the processes by which negative expectancy may lead to poor performance (Bridgeman, 1974; Stipek & Gralinski, 1996), others have argued (and shown) that beliefs about superior ability may, if erroneous, lead to arrogance, complacency, and equally impaired performance. Conversely, self-beliefs of poor intellectual ability may also lead to enhanced efforts and improve performance.

Dweck (1991) distinguished between those who believe intelligence is fixed (entity theorists) and those that believe it is malleable (incremental theorists). Entity theorists believe performance reflects ability and that clever people succeed irrespective of task difficulties or effort. On the other hand, incremental theorists believe performance reflects efforts and strategies of task completion. Further, they believe clever people are such if they master something difficult or some new problems. These implicit and opposite theories affect educational goal orientation and in turn affective, behavioural, and cognitive variables that may be self-fulfilling.

Bempechat, London, and Dweck (1991) and Dweck (1986, 1999) argued that BAI may not be related to actual intellectual competence and yet have direct paths to performance (particularly in educational settings). Generally, this would involve high expectancy leading to performance improvement, and vice versa, although it is also possible that overconfidence or excessively high expectancy may lead to the believe that academic success is a natural consequence of native intelligence and therefore reduce motivation and actual performance (Muller & Dweck, 1998). However, negative concepts may not always lead to improved performance. As Nauta, Epperson, and Wagoner (1999) showed, persistent university students tend to interpret their success as a consequence of their efforts rather than their ability (this was found even when controlled for intelligence). Thus, the relation between BAI and AP remains to be examined. Further, the possible influence of BAI on AP is yet to be tested against well-established personality and intelligence measures. Further, if BAI may have self-enhancing (or self-defeating) effects on AP, it seems important to identify the variables that influence these beliefs and, particularly, whether BAI may partly be explained in terms of personality and cognitive ability.

The aim of this study is twofold. First, it is set to explore the relationship of BAI with personality and cognitive ability. Second, it will examine the predictability of AP by BAI, personality, and cognitive ability. As noted above, there have been several recent studies that explored the relationship between personality traits and AP in university settings (Busato et al., 1999; Chamorro-Premuzic & Furnham, 2003a,b; De Raad, 1996; De Raad & Schouwenburg, 1996; Furnham & Medhurst, 1995; Furnham & Mitchell, 1991; Goff & Ackerman, 1992; Kling, 2001). However, none of these studies included a measure of cognitive ability. Hence, the predictive power of personality traits could not be compared to that of psychometric intelligence. On the other hand, the validity of BAI in the prediction of AP has yet to be examined in relation to personality and cognitive ability. Furthermore, there is little if any empirical

evidence on the relationship of BAI with well-established personality traits and cognitive ability. In line with the discussed literature, several sets of hypotheses can be stated:

H1: Personality traits will be significantly related to AP. Specifically, it is expected to replicate the significant correlations of AP with Neuroticism, Extraversion, and Conscientiousness reported in recent studies (e.g., Chamorro-Premuzic & Furnham, 2003a,b). It is thus expected that:

H1a: Conscientiousness will be significantly and positively related to AP and seminar performance. This would be consistent with the idea that conscientious students have more determination (Smith, 1969) and are intrinsically more motivated (Boekaerts, 1996; Furnham, 1995; Pelechano, 1972). Furthermore, given that conscientious individuals are characterised by higher achievement striving, dutifulness, order and responsibility, it can be expected that they obtain higher academic examination grades (Chamorro-Premuzic & Furnham, 2003a; De Raad & Schouwenburg, 1996). Moreover, because conscientious students are more likely to work hard and complete their course work assignments, it can be expected that Conscientiousness will be significantly related to seminar performance, which involves continuous assessment. It is thus expected that conscientious individuals will be rated higher in class, obtain better essay marks, and have lower levels of absenteeism.

H1b: Extraversion will be significantly and negatively related to AP and seminar performance. This would confirm that introverts tend to have an advantage over extraverts with respect to the ability to consolidate learning, as well as lower distractibility and better study habits (Entwistle & Entwistle, 1970; Eysenck & Cookson, 1969; Sanchez-Marin et al., 2001). As noted earlier, the negative relationship between Extraversion and AP would be in line with the findings of Rolfhus and Ackerman (1999) who reported negative associations between several knowledge tests and Extraversion. Further, since AP will be assessed through written examinations, it can be also expected that introverts have an advantage in the assessment method employed (Chamorro-Premuzic & Furnham, 2003a; Furnham & Medhurst, 1995; Robinson et al., 1993). With regard to seminar performance, it can be predicted that introverts will have higher essay marks than introverts.

H1c: Neuroticism will be significantly and negatively related to AP. This would be consistent with the idea that Neuroticism is likely to impair performance under stressful or arousing conditions, such as university examinations (Boyle, 1983; Hembree, 1988; Siepp, 1991; Zeidner & Matthews, 2000). Further, since Neuroticism is negatively related to self-estimated intelligence (Furnham et al., 2003) and self-concept (Well & Matthews, 1994), it can be expected that stability will be an advantage in academic settings, particularly when writing an examinations. When indicators of performance are obtained through continuous assessment (seminar performance), it is likely that neurotic students will show lower levels of attendance than their stable counterparts, as seminars are regarded as socially stressful. This would confirm previous findings (Chamorro-Premuzic & Furnham, 2002) and the idea that Neuroticism is associated with stress and physical illness (Matthews et al., 2000).

H2: Psychometric intelligence will be significantly and positively related to AP. This would replicate the extensive body of research in support of the predictive validity of cognitive ability tests in educational settings (e.g., Brody, 2000; Gottfredson, 2003; Jensen, 1980; Kuncel et al., 2001; Wolf, 1972; Zeidner & Matthews, 2000). However, considering that this study will examine AP in a competitive university

programme (where students have been carefully selected in terms of their previous academic accomplishments), the relationship between AP and cognitive ability is expected to be modest. This would confirm the research suggesting that the relation between psychometric intelligence and AP is weak in university settings (e.g., Mehta & Kumar, 1985; Sanders et al., 1955; Seth & Pratap, 1971; Singh & Varma, 1995; Thompson, 1934). Accordingly, it is also expected that intelligence will be significantly, albeit modestly, related to seminar performance.

H3: Personality traits will be a better predictor of AP and seminar performance than psychometric intelligence. This would be consistent with the idea that, whilst the predictive power of cognitive ability measures tends to decline at higher levels of formal education, the accuracy of personality inventories tends to increase (see Ackerman, 1994; Wolf, 1972). As mentioned earlier, this hypothesis can be explained in terms of the restriction of range in the distribution of psychometric intelligence scores across competitive and highly selective university programs.

H4: BAI will be significantly related to AP and seminar performance. Specifically, it is expected that the belief that intelligence is stable (entity) will be negatively related to AP, whilst the belief that intelligence can be increased over time (incremental) will be positively associated with AP. Likewise, incremental BAI are expected to predict higher seminar performance; that is, higher attendance, higher essay marks, and higher ratings of performance on the weekly seminar meetings. Thus, incremental BAI are expected to increase motivation and study habits, thus leading to higher AP (see Bempechat et al., 1991; Dweck, 1986; Nauta et al., 1999).

H5: BAI will be significantly related to personality traits. Although the relationship between the Big Five and incremental/entity BAI has not been investigated in the past, it is expected that:

H5a: Conscientiousness will be significantly related to BAI; that is, conscientious students will be more likely to think that intelligence can be increased over the life span because working hard may be either a consequence or a cause of believing that investing time and efforts in studies would pay off over time (see Dweck, 1999).

H5b: Introverts will be also more likely to believe that intelligence can be increased over the life span. This would be consistent with the idea that introverts invest more time studying and preparing for exams than extraverts.

2. Method

2.1. Participants

The sample was composed of 93 (70 females and 23 males) undergraduate students from University College London. Of the 1200 students that apply, around 100 are accepted every year at this elite institution. Admission is based primarily on school grades, as well as evidence of motivation, maturity, and stability. All students were fluent English speakers. Initial age ranged from 18 to 22, with an arithmetic mean of 19.3 (S.D. = 1.04) years.

2.2. Measures

2.2.1. Academic performance

AP data for each participant were recorded throughout two academic years in students' files. It was measured by overall exam marks based on five 3-h written exams (on a 1–100% scale where 32% is a pass and 70% is a first or distinction). Although the data were analysed separately for first- and second-year examination grades, the discussion of the results will be predominantly based on the overall exam grades, that is, the arithmetic mean of the total marks for each student. Overall exam grades ranged from 39.97 to 73.67, with an average of 62.04 (S.D. = 6.57).

2.2.2. Personality

Personality was assessed through the NEO-PI-R (Costa & McCrae, 1992). This well-established questionnaire is a 240-item measure of the Big Five personality factors: Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness. Items involve questions about typical behaviours or reactions, which are answered on a five-point Likert scale. Responses rage from "strongly disagree" to "strongly agree." There is a great deal of empirical literature over the past decade providing evidence of its concurrent, construct, convergent, divergent, incremental, and predictive validity (e.g., Costa & McCrae, 1992; Furnham, 1996; Matthews, 1997). Compared to comparable American student group norms shown in the manual, this sample was slightly higher in Neuroticism (102.93 vs. 96.3), lower on Extraversion (118.49 vs. 121.2), somewhat higher on Openness (129.9 vs. 116.8), almost identical on Agreeableness (113.27 vs. 113.5), and lower on Conscientiousness (105.14 vs. 114.5).

2.2.3. Seminar performance

Every week (throughout two academic years), participants attended a compulsory 1-h tutorial or seminar as part of their psychology degree. Four different seminar leaders (i.e., staff members) evaluated each student's presentation and discussion of diverse subjects and wrote a final report upon conclusion of each seminar on a standard form. Thus, there were two seminar leaders per year for 2 years. Seminar performance was given by three variables, namely, seminar behaviour (behaviour in class), absenteeism (level of attendance), and overall essay marks (for a total of 10 essays), all of which were aggregated scores across all semesters. Seminar behaviour was a measure on the 6 seven-point scales in which students were rated by their tutors. These scales were found to be sufficiently reliable: grasp of subject matter (α=.68), work habits (α=.69), motivation (α=.70), written expression (α=.69), oral expression (α=.71), and amount of participation (α=.73). Absenteeism was calculated in percentages for each participant [Total Number of Seminar Meetings/Seminar Meetings Missed∗100], and was also found to have sufficient internal and longitudinal reliability (α=.64). Overall essay marks were obtained by calculating the arithmetic mean for each participant (number of essays submitted was held constant, i.e., 10). The reliability of the overall essay marks was α=.75.

2.2.4. Cognitive ability

Cognitive ability was measured through the Wonderlic Personnel Test (WPT) (Wonderlic, 1992). This 50-item test is administered in 12 min and provides a reliable measure of general cognitive ability. Scores can range from 0 to 50. Items include word and number comparisons, disarranged sentences, serial analysis of geometric figures, and story problems that require mathematical and logical solutions. The test has impressive norms and correlates very highly (r=.92) with the WAIS-R (see Wonderlic,

1992). For the present sample, the mean score was 28.12 (S.D. = 5.28). The manual shows norms based on as $N = 118{,}549$, which suggest a modal score of 21. A score of 28 is in the 85th percentile.

2.2.5. Beliefs about intelligence

BAI were assessed through a self-report scale that comprised the following seven items: "Anyone who works hard could be one of the brightest in the class." "Every school child could do well in math if they worked hard." "Some children can never do well in math even if they try hard." "Everyone could do well in science if they worked hard." "Some kids will never be bright no matter how hard they try." "Some children can never do well in science even if they try hard." Most of these items were taken or adapted from Dweck's (1986, 1999) scale on entity/incremental BAI to make it appropriate for this particular sample. Based on the results of a previous pilot study, it was decided to include only half of the original items of this scale. These items showed sufficient internal reliability (α=.87) and a single factor was extracted via principal components. This factor accounted for 51% of the variance and was labelled BAI. A high score on this factor refers to *incremental* BAI (that is, the belief that intelligence can increase across the life span), whilst a low score on this factor refers to *entity* BAI (that is, the belief that intelligence is stable and unchangeable).

3. Results

Table 1 presents the correlations (and partial correlations) between AP (first, second, and overall examination grades), BAI, cognitive ability (WPT), the Big Five personality traits (Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness), and gender. As predicted, personality was significantly related to AP (findings were consistent with H1). There were positive and significant correlations between Conscientiousness and AP (results were consistent with H1a), and negative correlations between Extraversion and AP (the results were consistent with H1b). However, correlations between AP and Neuroticism were not significant (the results were not consistent with the prediction of H1c). Participants who believed that intelligence is fixed (entity) were more likely to have lower Conscientiousness scores, and vice versa. AP was also significantly correlated with gender

Table 1
Correlations between BAI, personality (Big Five), cognitive ability, gender, and AP

	BAI	Exams—first year		Exams—second year		Exams—overall	
BAI	–	.01	(.03)	.02	(.02)	.01	(.03)
Neuroticism	−.07	.18	(.11)	.08	(.04)	.14	(.08)
Extraversion	−.15	−.36**	(−.37**)	−.22*	(−.30**)	−.29**	(−.35**)
Openness	.09	−.19	(−.22)	−.09	(−.16)	−.16	(−.22)
Agreeableness	−.01	.10	(−.04)	.01	(−.01)	.06	(−.02)
Conscientiousness	.29*	.44*	(.48**)	.34**	(.37**)	.40**	(.44**)
Cognitive ability	−.07	.05	–	.10	–	.07	–
Gender	.08	.20	–	.26*	–	.26*	–

* $P < .05$ (partialling out gender and cognitive ability).
** $P < .01$ (partialling out gender and cognitive ability).

(females obtained higher grades than males). As predicted, BAI were significantly correlated with Conscientiousness (results were consistent with H5). With regard to the relation of AP with psychometric intelligence and BAI, results did not support initial hypotheses since AP was not significantly correlated with neither intelligence (findings were not consistent with the prediction of H2) nor BAI (H4 was not confirmed). When gender and cognitive ability were partialled out, a similar pattern of results was obtained, indicating that the correlations of personality traits and BAI with AP were not affected by neither gender nor cognitive ability.

In the case of BAI, the data were further explored. BAI scores were first split into three groups, that is, extremely low, intermediate, and extremely high, representing a categorisation equivalent to entity, intermediate, and incremental beliefs; ANOVA was performed on the data to test the possibility of a quadratic relation (particularly whether intermediate scores on BAI are related to higher AP). Results indicated that there were no significant group differences in examination grades [$F(2,69) = 1.23$, $P =$ not significant]. Thus, BAI were not significantly related to AP.

A series of hierarchical regressions were then performed on the data in order to test the predictability of AP (first, second, and overall exam marks) by BAI, personality traits, cognitive ability, and gender. Results are summarised in Table 2.

As can be seen, neither BAI nor psychometric intelligence were significant predictors of AP. H2 and H4 were thus not confirmed. However, results showed that personality was a significant predictor of AP, accounting for almost 20% of unique variance. This was consistent not only with H1 but also with H3. Further, it can be seen that most of this variance was accounted for by Conscientiousness, which was found to be the most significant predictor of AP (this was further consistent with H1a), although

Table 2
St. β coefficients and t values for the predictors of AP after hierarchical regressions

	Exams—first year		Exams—second year		Exams—overall	
	St. β	t	St. β	t	St. β	t
BAI	− .15	1.37	− .15	1.24	− .16	1.37
$F(1,68)$	.11		.04		.07	
Adj. R^2	.01		.01		.01	
Neuroticism	− .01	.07	− .10	.71	− .06	.45
Extraversion	− .27	1.85	− .31	1.98*	− .31	2.04*
Openness	− .05	.41	.05	.38	.00	.03
Agreeableness	.00	.02	− .04	.34	− .02	.19
Conscientiousness	.43	3.82**	.33	2.68**	.40	3.38**
$F(6,63)$	4.80**		2.37*		3.69**	
Adj. R^2	.25		.11		.19	
Cognitive ability	.06	.58	.10	.87	.08	.78
$F(7,62)$	4.09**		2.13*		3.20**	
Adj. R^2	.24		.10		.18	
Gender	.21	1.89	.27	2.23*	.25	2.19*
$F(8,61)$	4.17**		2.57*		3.57**	
Adj. R^2	.27		.15		.23	

* $P < .05$.
** $P < .01$.

Extraversion was also a significant predictor in the model (this was in line with the prediction of H1b). As can be observed, and confirming the correlational pattern, gender was a significant predictor in the final model, accounting for additional variance in AP (women obtained higher grades than men).

A second series of regressions was carried out to test the predictability of BAI by personality traits, cognitive ability, and gender. Results are summarised in Table 3. As can be noted, personality was a significant predictor of BAI, in particular, Conscientiousness (this was in line with the correlations of Table 1 and consistent with H5a) and Extraversion (this was consistent with H5b) were significant predictors of BAI. Although no significant associations between BAI and Openness to Experience had been predicted, it was also found that Openness was a significant predictor of BAI. Thus, conscientious, introverted, and open individuals were all more likely to believe that intelligence could be increased throughout the life span (incremental BAI), and vice versa.

Further correlations were computed on the data in order to examine the relation between personality, BAI, cognitive ability, gender, and seminar performance (absenteeism, essay marks, and behaviour in class) (see Table 4. As can be observed, several indicators of seminar performance were significantly correlated with absenteeism (stable students tended to attend more seminars) (this was in line with H1c). Likewise, conscientious participants were also more likely to have higher attendance rate (in line with H1a). Essay marks were significantly correlated with Extraversion (negatively) and Conscientiousness (positively), which also correlated significantly with class behaviour (conscientious students were more likely to be rated higher for their contribution in class). In addition, BAI were positively and significantly correlated with essay grades (incremental BAI were associated with higher marks) (consistently with H4), whilst there were no significant correlations between seminar performance and either grades or cognitive ability. When gender and cognitive ability were partialled out, results showed little variation, indicating that the correlations of personality traits and BAI with seminar performance were not affected by neither gender nor cognitive ability.

Table 3
St. β coefficients and t values for the predictors of BAI after hierarchical regressions

	BAI	
	St. β	t
Neuroticism	− .16	1.18
Extraversion	− .33	2.11*
Openness	.26	1.98*
Agreeableness	− .02	.14
Conscientiousness	.27	2.24*
F(5,65)	2.57*	
Adj. R^2	.10	
Cognitive ability	− .08	.68
F(6,64)	2.22*	
Adj. R^2	.09	
Gender	.11	.89
F(7,63)	2.01	
Adj. R^2	.09	

* $P < .05$.

Table 4
Correlations between BAI, personality, cognitive ability, gender, and seminar performance

	Seminar performance					
	Absenteeism		Essay marks		Behaviour in class	
BAI	−.12	(−.11)	.26**	(.36**)	.04	(.03)
Neuroticism	.22*	(.22*)	.08	(.02)	−.05	(−.04)
Extraversion	.12	(.14)	−.36**	(−.35**)	−.14	(−.12)
Openness	−.11	(−.12)	−.20	(−.20)	−.02	(−.02)
Agreeableness	−.17	(−.18)	−.20	(−.18)	.20	(.22*)
Conscientiousness	−.25*	(−.24*)	.47**	(.46**)	.40**	(.41**)
Cognitive ability	.07	–	.02	–	.19	–
Gender	.08	–	.05	–	−.12	–

High scores on BAI indicate incremental beliefs, whilst low scores on BAI indicate entity beliefs.
* $P < .05$ (partialling out gender and cognitive ability).
** $P < .01$ (partialling out gender and cognitive ability).

A final series of hierarchical regressions were performed on the data in order to test the predictability of seminar performance (behaviour in class, absenteeism, and overall essay marks) by BAI, personality traits, cognitive ability, and gender. Results are summarised in Table 5. As can be seen, personality was the most significant predictor of all seminar performance indicators, with Conscientiousness being a robust predictor (this was consistent with H1 and, particularly, H1a). In addition, Neuroticism was a

Table 5
St. β's and t values for the predictors of seminar performance after hierarchical regressions

	Seminar performance					
	Absenteeism		Essay marks		Behaviour in class	
	St. β	t	St. β	t	St. β	t
BAI	−.10	.68	.10	.67	−.06	.52
$F(1,68)$	.89		7.68**		.67	
Adj. R^2	.01		.11		.00	
Neuroticism	.29	2.09*	−.21	1.41	−.04	.29
Extraversion	.10	.85	−.23	1.32	−.23	1.41
Openness	−.05	.43	−.02	.15	.24	1.76
Agreeableness	−.20	1.68	.20	1.67	.09	.80
Conscientiousness	−.28	2.07*	.44	3.05**	.40	3.32**
$F(6,63)$	2.43*		5.29**		2.95**	
Adj. R^2	.14		.33		.15	
Cognitive ability	.03	.38	.01	.04	.25	2.26*
$F(7,62)$	2.39*		4.41**		3.46**	
Adj. R^2	12		.31		.20	
Gender	.05	.47	.03	.20	−.06	.50
$F(8,61)$	2.27*		3.81**		3.01**	
Adj. R^2	.11		.30		.19	

* $P < .05$.
** $P < .01$.

significant predictor of absenteeism (high Neuroticism was associated with lower attendance, and vice versa). In addition, cognitive ability was shown to be a significant predictor of behaviour in class (higher IQ was associated with higher ratings for contribution to class).

4. Discussion

This study has examined the relationship between AP, seminar performance, (entity vs. incremental) BAI, personality, cognitive ability, and gender in a sample of British undergraduate students over a 2-year period. As such, it has attempted to compare the predictability of AP and seminar performance by personality, BAI, cognitive ability, and gender. Furthermore, this study has also aimed at examining the relationship of BAI with personality and intelligence.

With regard to the relationship between personality traits and AP and seminar performance, correlational analyses confirmed that the Big Five traits Conscientiousness (positively) and Extraversion (negatively) are significantly associated with performance on both blind-evaluated examinations and tutor-rated weekly seminar meetings aggregated over four seminar leaders. Introverted and conscientious students are therefore more likely to excel in university than their extraverted and nonconscientious counterparts, as hypothesised. Furthermore, results also indicated that stable students are more likely to have higher levels of attendance than neurotic ones (this is in line with the findings of Chamorro-Premuzic & Furnham, 2002).

Contrary to expectations, Neuroticism was not significantly related to exam performance, though it was to absenteeism. Interestingly, Openness to Experience was negatively related to exam performance though not significantly. It has been suggested that Openness may be a marker of intelligence (Ackerman & Heggestad, 1997; Zeidner & Matthews, 2000) though in this population the correlation between Openness scores and the WPT was not significant. It is possible that the divergent and imaginative thinking style and curiosity associated with Openness is however not beneficial to students sitting classic British written essay examinations. However, the correlation between Openness and overall essay marks was also negative, suggesting that as a personality trait it may have little positive impact on all aspects of university academic life, except perhaps in the fine or performing arts.

As predicted, a series of hierarchical regressions also confirmed that personality traits are moderate and significant predictors of academic success as assessed both through examinations (AP) or continuous assessment (seminar performance). Personality traits accounted for around a fifth of the variance in exams and as much as a third in the variance of essay marks written for (and marked by) four different tutors over a 2-year period. Consistent with the correlations, it was found that Conscientiousness is a robust predictor of AP and seminar performance and, to a lesser extent, the same can be said for Extraversion. The present results are therefore consistent with several recent findings (on different population groups) on the relationship between personality traits and AP (Chamorro-Premuzic & Furnham, 2003a,b; Furnham & Medhurst, 1995; Petrides et al., in press; Robinson et al., 1993).

In the case of Extraversion, it is possible that introverts would have an advantage over extraverts with respect to the ability to consolidate learning, as well as lower distractibility and better study habits (Entwistle & Entwistle, 1970; Eysenck & Cookson, 1969; Sanchez-Marin et al., 2001). Further, it is also likely that Introversion rather than Extraversion may be advantageous for knowledge acquisition (Rolfhus & Ackerman, 1999), possibly due to the fact that introverts spend more time studying alone

than extraverts. It is important to point out however that Introversion is not an advantage in seminars themselves, which are clearly more comfortable for extraverts. Similarly, higher levels of achievement striving, dutifulness, order and responsibility, all of which are associated with Conscientiousness, may facilitate academic success (Chamorro-Premuzic & Furnham, 2003a; De Raad & Schouwenburg, 1996), particularly in this sample whose mean score was nearly half a standard deviation below American norms. Term essays and exams require considerable effort acquiring, reading, memorising, and criticising books and papers. Being hardworking clearly leads to positive results. Accordingly, the results of this study confirm that careful, organised, hardworking, persevering, and achievement-oriented students may be expected to succeed in academic settings. Furthermore, and perhaps less unsurprisingly, the results show that a brief self-report scale to assess Conscientiousness is a much more powerful predictor of AP and seminar performance than cognitive ability. The mean score on the Wonderlic test of this population indicated that the sample was above the norm, however, the S.D. indicated sufficient variability. It may be that intelligence operates at a cut-off level such that beyond a certain point it has only modest effects on university results as they are currently determined.

Although cognitive ability was expected to be significantly associated with AP and seminar performance, it was only significantly (and modestly) related to behaviour in class, and virtually unrelated to examination grades, essay marks, and attendance levels. Moreover, and as mentioned above, the predictive power of cognitive ability was very low compared to that of personality traits. These results may be explained in terms of the highly selective sample, which was composed merely of elite university students. Given that selection criteria are based on previous academic excellence (achievement in school and A levels), participants' intellectual ability levels may be expected to be clearly above average. This hypothesis was confirmed when the descriptive statistics for the present sample were compared to the norms and showed the mean for the group to be in the 85th percentile. Whilst there was still a good near-normal distribution of scores on this test, it may be advisable to use more discriminatory tests like the AH5 designed specifically to test elite university students' intelligence (Heim, Watts, & Simmonds, 1970).

It is unclear whether tests of fluid or crystallised intelligence would be more clearly related to these dependent variables. Certainly, the implication is that, once selected, it is effort rather than ability that best determines university success. Further, it is probably more difficult to measure effort rather than ability, both because of problems with dissimulation in interviews and personality inventories but also because the former is considerably less stable than the latter.

With regard to the relationship between individual differences (personality traits and cognitive ability) and BAI, it was found that Conscientiousness and, to a lesser extent, Extraversion and Openness to Experience, were all significantly associated with BAI. Incremental BAI were related to high scores on Conscientiousness and Openness, as well as low scores on Extraversion, whilst entity BAI were linked to low scores on Conscientiousness and Openness, as well as higher scores on Extraversion. Further, the results of the regressions indicated that personality traits significantly account for approximately 10% of the variance in BAI. Accordingly, an individual's personality may be expected to shape his/her ideas about the nature of intelligence, specifically with regard to his/her efforts and work habits. However, since BAI were not significantly related to AP or (with the exception of essay marks) seminar performance, it is likely that those beliefs do not have any objective influence on an individual's performance. Whether an individual will excel or fail in academic settings seems to depend on his/her personality (particularly on his/her level of Neuroticism, Extraversion, and Conscientiousness) rather than on whether he/she believes that intelligence can be increased through hard work.

No doubt, conscientious students have their incremental BAI confirmed. That is, they see that hard work yields better results, which are often taken as an indicator of intelligence. Interestingly, studies on nonstudent adults have suggested that Conscientiousness is negatively correlated with intelligence, and it has been suggested that less bright people learn to become (more) conscientious to help up with their more able colleagues (Moutafi et al., in preparation). However, the correlation between Conscientiousness and psychometric intelligence in this sample was virtually zero ($r = -.01$). Further, university teachers (and perhaps teachers in general) consistently emphasise the importance and benefit of hard work which no doubt reinforces incremental belief systems.

This study has shown that among an elite, highly selected student body, personality traits (but not cognitive ability) are clearly related to various measures of academic success such as final examinations, written essays, and continuous assessment. Further, personality traits are related to beliefs about the nature of intelligence, which is related specifically to continuous assessment of university performance (but not examinations). More importantly, this study has suggested that between a fifth and a third of the variance in marks can be accounted for by personality traits and two in particular, namely, Conscientiousness and Extraversion. This has implications for university selection. The results suggest that both conscientious and introverted (and to a lesser extent stable and female) students are likely to do better at least under the British system. Indeed, it is possible that as continuous assessment projects tend to count more towards final grades than examinations, these traits will play an ever-increasing role in determining grade outcomes. The results suggest that once suitable levels of intelligence are met, personality variables play an increasing role in educational outcomes, which mitigates in favour of psychometric tests for university screening.

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