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Personality and Motivation Predict Performance

Abstract

A longitudinal survey was conducted over two years to explore models of undergraduates' grade point average (GPA) among first (N = 172) and second (N = 77) year university students. Motivationally-relevant constructs were measured at global (i.e. conscientiousness), contextual (i.e. achievement motivation) and situational (i.e. performance efficacy and grade goals) levels. Data was collected over five time points and structural equation modeling was used to examine a hierarchical motivational sequence specified by neo-socioanalytic theory. The findings support a hierarchical sequence of motivation whereby global factors influence achievement through increasingly more proximal and performance-related processes. However, cognitions specific to performance (i.e. performance efficacy and grade goals) exhibited predictive utility among the year 2 group only, who had more experience at university.

Personality and Motivation Predict Performance

Psychological measures have been found to correlate with academic performance, especially in post-compulsory educational settings where study motivation is less regulated by teachers and parents. Moreover, the restricted range of intelligence scores among university students (e.g., Borkowski & Thorpe, 1994) indicates that self regulatory factors may be particularly important to university achievement. Consequently, psychological assessments have the potential to identify students who may be at risk of under performing and to facilitate the design and evaluation of student support interventions intended to promote improved academic outcomes (Ancis & Sedlacek, 1997).

Students' average mark attained at university (referred to as grade point average; GPA) is meaningful to students during their studies and the only commonly available, objective measure of academic achievement. Many correlates of GPA have been identified yet few studies have attempted to integrate these theoretically. The most salient predictors can be divided into global personality factors (e.g., conscientiousness), trait like dispositions (e.g., achievement motivation) and, finally, cognitions relevant to performance outcomes (e.g., performance self efficacy and grade goals). The neo-socioanalytic theory (NST; Robert & Woods, 2006) of personality may provide a useful framework for integrating these most salient correlates of GPA.

Neo-Socioanalytic Theory

According to NST, global personality factors such as conscientiousness which are relatively stable across time and context are the most general and distal determinants of performance. Task-relevant traits, related to specific behavioural domains (such as studying), are referred as mid-level trait-like factors. These are presumed to be influenced by situational factors and, therefore to be less stable over time and context. At the most proximal level, discrete thoughts, feelings and behaviours are proposed to be influenced by mid and higher level traits in addition to more

immediate environmental factors and are therefore the least stable level. In this hierarchical sequence, lower order factors are proposed to be subsumed by those above them and to provide putative mechanisms by which higher-order; more global factors influence performance and achievement (Fleeson, 2001; Hooker & McAdams, 2003; Roberts & Wood, 2006).

The big five personality dimensions (McCrae & Costa, 1987) have been shown to predict university GPA when measured during the first term of university (Chamorro-Premuzic & Furnham, 2003a, 2003b; Furnham, Chamorro-Premuzic, & McDougall, 2003) accounting for approximately 15% of the variation in students' marks. A recent meta analytic review reported a small to medium effect of conscientiousness (C) on GPA ($\rho = .24$, $k = 23$, $N = 5878$) and modest mean weighted correlations for the remaining factors, extraversion (E), neuroticism (N), openness (O) and agreeableness (A) with ρ s ranging from $-.05$ to $.06$ (O'Connor, & Paunonen, 2007). This pattern of results was largely confirmed by Poropat (2009) who reported ρ s of $.22$ (C), $.12$ (O), $.07$ (A), $.02$ (emotional stability) and $-.01$ (E). Thus, of the personality factors, (C) is the most strongly correlated with academic performance which is unsurprising since conscientious students are deemed to be more organised, careful, dependable, self-disciplined and achievement orientated (McCrae & Costa, 1987).

In a broader meta analysis of correlates of educational outcomes among university students achievement motivation was identified as one of the strongest correlates of GPA (Robbins, Lauver, Le, Davis, Langley, & Carlstrom, 2004; $\rho = .30$, $k = 17$, $N = 9,330$). Achievement motivation refers to students' capacity to persist with academic work in the face of challenge (e.g., 'when work is difficult, I either give up or study only the easy parts', Weinstein, Palmer, & Schulte, 1987). Consistent with neo socioanalytic theory, a high association between measures of achievement motivation and C ($r_s = .66$ and $.65$ for males and females, respectively) is reported, indicating that achievement motivation may be better

conceptualised as a domain-specific personality trait rather than a motivational, acquired self-regulatory capacity (Richardson & Abraham, 2009). Additionally, Richardson and Abraham, (2009) found that achievement motivation fully mediated the relationship between C and GPA.

NST proposes that performance-related cognitions provide more direct casual links to behaviour and are more amenable to change. This is consistent with many social cognitive theories such as goal theory (Locke & Latham, 1990 and see also Ajzen, 1991; Chen, Gully, Whiteman, & Kilcullen, 2000; Kanfer, 1992; Lee, Sheldon & Turban, 2003; Phillips & Gully, 1997; Vallerand & Ratelle, 2002). Goal theory focuses on the relationship between goal level and task performance and proposes that ambitious goals (e.g., obtaining a GPA of 65% or more) enhance goal commitment and motivation and are, therefore, associated with better performance outcomes than less-demanding goals (e.g., obtaining a GPA of 50% or more). Studies examining the grade goal /GPA combination report moderate to strong associations (r s range from .27 to .40, Chen et al., 2000; Phillips & Gully, 1997).

Goal setting is closely linked to self efficacy, defined as the “belief in one’s capabilities to organize and execute the courses of action required to produce given attainments” (Bandura, 1997, p3). High academic self efficacy has been shown to promote the setting of higher goals and has also been linked to greater volitional efficiency including attention and thought control (e.g., Ackerman, Kanfer & Goff, 1995). Thus, to the extent self efficacy reflects actual control (Ajzen, 1991); it may also directly influence performance outcomes. Reviews that examine self efficacy and GPA report an association of $r_+ = .35$ ($k = 11$, $N = 1924$) (Multon, Brown, & Lent 1991) and $\rho = .50$ ($k = 18$, $N = 9598$) (Robbins et al., 2004). Of the self efficacy measures, studies summarised in Robbins et al.’s (2004) review revealed that milestone efficacy (e.g., Elias & Loomis, 2002; Lent, Brown, & Larkin, 1984), referred to from here as performance efficacy was most strongly associated with GPA. This is

unsurprising as relationships between social cognitions and other constructs are strongest when measured at corresponding measurement levels. Consequently, performance efficacy (e.g., “confidence in attaining a GPA of 65% or more”) is expected to be more strongly associated with GPA than more general beliefs about academic ability (e.g., “I think of myself as a very able student”) (cf. Pajares and Miller, 1995).

Performance feedback is central to goal setting. It is difficult to adjust the level or direction of goal directed effort when information about current performance is unavailable (Locke & Latham, 1990). Supporting this, the predictive utility of self efficacy has been shown to improve after experience of university (Gore, 2006) presumably because skills and performance experiences, including grades received on assessments, have accumulated (Bandura, 1997; Lent & Brown, 2006; Wood & Locke, 1987). Consequently, performance-efficacy and grade goals are expected to exhibit more predictive utility among students with greater university experience.

Citing Barrick, Mount, and Strauss (1993), Poropat proposed that students low on conscientiousness may fail to optimise their performance because of reduced effort and poor goal setting. Poropat suggested that such students could benefit from additional training and that teaching methods could be adjusted to meet their needs. Considering these proposals in the context of Neo-socioanalytic theory implies that mid-level, dispositional traits such as achievement motivation and discrete performance-related cognitions such as grade goals and performance efficacy are the proximal processes that account for low-C students’ poorer performance, with situational-level performance-related cognitions (such as performance efficacy and goals) being shaped by both global (e.g., conscientiousness) and contextual (e.g., achievement motivation) factors.

Aims and hypotheses

There is substantial literature on correlations between personality traits and students’

performance but less clarity about how traits relate to specific study skills and motivational factors that regulate behavior. Neo-socioanalytic theory may provide a useful framework for integrating these constructs. The closer to university entry that tendencies predictive of final performance can be identified the more scope there is for intervention. Consequently, we sampled first year students in their first term. We also investigated a separate sample of second year students so we could compare models during early and later stages of cumulative feedback and skill development. Data was collected for each group at five time points over a period of two years.

The proposed model explored associations between C, achievement motivation, initial performance efficacy (PE_1) and subsequent performance efficacy (PE_2), initial (GPA_1) and subsequent (GPA_2) achievement and grade goals. Following neo socioanalytic theory, the influence of C on self efficacy and GPA was expected to be mediated or partially mediated by achievement motivation. Similarly, the influence of achievement motivation on GPA was expected to be mediated or partially mediated by performance efficacy. Following goal theory, grade goal was expected to mediate or partially mediate the influence of performance efficacy on GPA_2 . Additionally, as cumulative performance feedback is central to the formation of social cognitive beliefs, performance efficacy and grade goals were expected to partially mediate the influence of initial GPA on subsequent achievement. Following on from Gore (2006) we expected the relationship between performance related cognitions and academic performance to be stronger among year 2 students than for those in year 1. Figure 1 displays the proposed theoretical model. Note that only the indirect paths relating to the proposed mediation model are depicted.

Method

Participants and Procedure

Data was collected at five time points over two years for two cohorts of university students. First (2006 entry cohort) and second year (2005 entry cohort) full time undergraduate students were invited to take part. Conscientiousness was measured at time 1 (October, 2006) and at time 2, prior to end of year examinations; achievement motivation and performance efficacy were measured (May, 2007). At time 3 (July, 2007) students initial end of year GPA scores (GPA_1) were obtained from university records. Items at time 4 (October, 2007) measured after the summer vacation, included a second measure of performance efficacy (PE_2) and grade goals. Finally, in July (2008) subsequent end of year GPA (GPA_2) was obtained from university records. Other measures not included here were also measured at time 1, details of which are reported elsewhere (Richardson & Abraham, 2009).

All first and second year students studying at the university were sent the first questionnaire and were recruited according to a standardised protocol. Students were asked to report their email address so that follow-up questionnaires could be sent and permission to access students' university records was sought. Additionally, participants were asked to report their gender, date of birth and degree course title so that their responses could be matched anonymously across time points and with GPA scores stored on university records. Participants were offered free entry into a prize draw and had the chance to win one of four £25 cash prizes. Psychology students could opt out of the draw if they preferred to receive mandatory course credits for research participation. All participants were ensured that involvement was voluntary, responses would remain confidential and withdrawal from the study was possible at any time. Study debriefing took place after final self report measures were submitted. Failure to match questionnaire responses across time points and to GPA scores held on university records was primarily due to incomplete reporting of the data

necessary for identification purposes, student dropout or referral and participants refusing permission for us to match their responses to their grades held on university records.

Nine hundred and ninety nine full time first and second year undergraduate students studying at a UK university were recruited. Of these 587 and 412 first and second years, respectively took part. Of the 587 first term, first years 238 (41%) completed questionnaire responses at time 2, and of these 172 (72%) were matched to GPA₁ scores at time 3. 118 of these (69%) completed questionnaire responses at time 4 and 82 (69%) of these were matched to GPA₂ scores held on university records. Of the 412 second year students, 158 (38%) completed questionnaire responses at time 2, and 127 (80%) of these were matched to GPA₁ scores at time 3. 101 of these (80%) completed questionnaire responses at time 4 and of these we were able to match 77 (76%) to GPA₂ scores held on university records. Table 1 displays a breakdown of the samples characteristics by gender, age and entry year (06/05).

To assess the representativeness of our samples *t* and chi square tests were conducted to compare GPA scores and gender distributions with the cohort from which they were drawn. In both groups there were significant differences in GPA₁, year 1, $t(2166) = 7.54, p < .05, M = 65.62, SD = 7.12$; year 2, $t(2223) = 3.35, p < .05, M = 62.77, SD = 7.34$ and GPA₂, year 1, $t(1764) = 3.52, p < .05, M = 64.22, SD = 7.04$; year 2, $t(1751) = 2.29, p < .05, M = 65.37, SD = 6.13$ compared to the cohort means, GPA₁, year 1, $M = 59.18, SD = 11.00$; year 2, $M = 59.17, SD = 11.98$; GPA₂, year 1, $M = 59.94, SD = 10.90$; year 2, $M = 63.06, SD = 8.76$ suggesting that respondents did marginally better than other students in their year, gaining approximately 2-5% higher marks. GPA₁ data was also available for a higher proportion of female students, year 1, $\chi^2(1) = 21.58, p < .01(80\%)$; year 2, $\chi^2(1) = 23.81, p < .01(83\%)$ as was the case for GPA₂, year 1, $\chi^2(1) = 22.24, p < .01(84\%)$; year 2, $\chi^2(1) = 22.04, p < .01(83\%)$ compared to relevant cohort distributions (year 1; 57% female versus 43% male; year 2; 59% female versus 41% male) and (year 1; 61% female versus 39% male; year 2, 60%

female versus 40% male) for GPA₁ and GPA₂ respectively. These findings indicate that our samples included more females and somewhat more highly-achieving students than the cohorts from which the samples were drawn, presumably because these students are more motivated to participate in research into psychological antecedents of academic performance.

Measures

As with most UK university students, our participants were awarded overall end-of-year mean percentage marks (GPA) out of 100 combining all formally assessed pieces of coursework and unseen examinations taken that year. Measures of initial performance (GPA₁) were measured at time 3 (July, 2007) and represent year 1 and year 2 GPA scores for the year 1 and year 2 groups respectively. Subsequent performance (GPA₂) was measured one year later (July, 2008) and represents year 2 and year 3 GPA scores for the year 1 and year 2 samples respectively. These GPA scores were all end of year scores, not cumulative scores across years. As with most UK universities, GPA obtained in year 1 does not contribute to final GPA. Year 2 and year 3 GPA however, comprise 40% and 60% respectively of the overall GPA officially awarded. In the UK final GPA marks are translated into degree classifications. Students with a GPA score of 70% or more are awarded a first class classification while students scoring 60-69, 50-59 and 40-49 are awarded 2:1, 2:2 and 3rd class classifications, respectively

All remaining constructs were self reported on Likert type response scales. Multi-item scale scores were computed by averaging participants' responses across the relevant items. Table 2 presents the means, standard deviations, and Cronbach's alphas of the study measures.

Items specified by the V44 personality inventory (John, Donahue, & Kentle, 1991) were used to measure *conscientiousness* (e.g., "does a thorough job"). For each item participants were presented with a series of statements and asked to indicate the extent to which they agreed or disagreed with them on 5 point anchored response options ranged from 'strongly disagree' to 'strongly agree'.

The 8-item motivation sub-scale from Weinstein Palmer & Schulte's (1987) learning and study strategies inventory (LASSI) was used to measure *achievement motivation*. Participants were required to rate the typicality of eight statements about them, on five point scales ('not at all typical of me' to 'very typical of me'). Individual items were designed to capture motivational persistence (e.g., "when work is difficult, I either give up or study only the easy parts") during challenging goal striving.

Performance efficacy was measured using 4 items, that were modified from the academic self efficacy scale (Elias & Loomis, 2002) based on Lent, Brown and Gore (1997) and Lent, Brown and Larkin (1986). Items specified students' confidence in their ability to achieve a specific grade (see too Phillips, Abraham & bond, 2003). A pilot study ($N = 40$) had shown that 64% and 62% was the average GPA that first and second year undergraduates felt confident in obtaining, respectively. Thus, in order to reduce restriction of range problems, and negative skew in the distribution of students' responses, all items referred to obtaining a score of 60% or 65% (or better). The following four items provided an index of performance efficacy: "earn a mean weighted score of 60% (or better) at the end of this academic year", "earn a mean weighted score of 65% (or better) at the end of this academic year", "graduate with a mean weighted score of 65% (or better)", "graduate with a mean weighted score 60% (or better)". Responses were recorded on 10 point scales that ranged from 'no confidence' to 'complete confidence'. Based on Locke and Latham, (1990) *grade goal* was indexed using a single item that asked students to state "the minimum (that is the least you would be satisfied with) percentage grade goal for the next year (on a scale of 0% to 100%)?" Students reported percentage scores using an open response format.

Analytic Strategy

Hypotheses were tested in three analytic steps. First correlations between predictor variables and GPA scores were examined. Second, structural equation modelling was used to assess the

adequacy of the proposed model of academic performance. In order to examine the mediation effects the direct paths for each of the proposed independent variables (in the mediation hypotheses) were also specified. Third, the hypothesized mediation effects were examined using Baron and Kenny's (1986) criteria and corresponding indirect effects were examined for statistical significance using Sobel's (1982) test.

The EQS 6 programme (Bentler, 2006) was used to test the study hypotheses and the maximum likelihood method was used for all analyses. As the chi-square goodness of fit statistic is sensitive to sample size (Marsh, Balla & McDonald, 1988) additional recommended indexes for goodness of fit were used to evaluate the adequacy of the proposed models (e.g., Hu & Bentler, 1999). Specifically, the comparative fit index (CFI), non-normed fit index (NNFI) and the root mean square error of approximation (RMSEA) are reported. In general non significant chi square values are indicative of good model fit while CFI and NNFI values of .90 (or above) and RMSEA values of .08 or lower reflect adequate model fit.

According to Barron and Kenny (1986) mediation is evident where 1) the independent and dependent variables are associated, 2) the independent and the mediating variables are associated and 3) when the dependent, independent and mediator are modelled simultaneously the influence of the mediator on the dependent variable should have a significant unique effect and 4) the influence of the independent variable on the dependent variable should either be increased (partial mediation) or restored (full mediation) when the path from the mediator to the criterion is constrained to zero in a multivariate test of their associations. Conditions one and two were examined using the correlation matrices. To test the third criterion the beta coefficient from the focal mediating variable to the focal dependent variable was examined to see if it was significant in the overall structural model. The fourth criterion was established by constraining the direct path from the focal mediating variable to the relevant dependent variable to zero and re-estimating the model. If the direct path from the focal independent variable to the focal

dependent variable increased or was fully restored partial mediation or full mediation is said to have occurred, respectively. Finally, corresponding indirect effects were examined for statistical significance using Sobel's (1982) test.

Results

Missing Data and Representativeness Check

Listwise deletion procedures were employed to handle missing data. To check sample representativeness *t* tests were used to compare participants whom remained in the study at time 3 and time 5 with those who did not. Among the first year group participants who had dropped out by time 3 had lower levels of C, $t(564) = 4.45, p < .001$, ($M_s = 3.00$ and 3.25) and by time 5 had lower levels of C, $t(564) = 4.37, p < .001$ ($M_s = 3.04$ and 3.35), achievement motivation, $t(238) = 2.24, p < .05$ ($M_s = 3.61$ and 3.79), and PE_2 , $t(236) = 2.56, p < .05$ ($M_s = 6.25$ and 6.74). Among the year 2 group participants who dropped out of the study by time 3, $t(404) = 2.49, p < .05$, ($M_s 3.24$ and 3.39) and by time 5, $t(404) = 1.84, p < .07$ ($M_s = 3.27$ and 3.39) had lower levels of C.

Correlations between study variables

Table 3 presents the correlations between the study variables for first (above the diagonal) and second year (below the diagonal) groups. C was a positive correlate of GPA_1 among both first ($r = .24$) and second ($r = .22$) year groups but was not correlated with GPA_2 (year 1, $r = .04$; year 2, $r = .16$). C was highly correlated with achievement motivation in both groups (year 1, $r = .57$; year 2, $r = .57$) which in turn was positively correlated with GPA_1 (year 1, $r = .36$; year 2, $r = .39$), GPA_2 (year 1, $r = .16$; year 2, $r = .38$), PE_1 (year 1, $r = .41$; year 2, $r = .37$), PE_2 (year 1, $r = .26$; year 2, $r = .34$), and grade goals (year 1, $r = .33$; year 2, $r = .36$). C was also correlated with PE_1 in both groups (year 1, $r = .30$; year 2, $r = .23$) but not with PE_2 . PE_1 in turn was significantly correlated with GPA_1 ($r_s = .29$ and $.36$ for year 1 and year 2, respectively) and PE_2 ($r_s = .67$ and $.70$ for year 1 and year 2, respectively). Interestingly, PE_2 ,

was not related to either GPA₁ or GPA₂ among the year 1 group ($r_s = .09$ and $-.01$, respectively). However, among the second year group, PE₂ was significantly correlated with both GPA scores ($r_s = .56$ and $.47$ for GPA₁ and GPA₂, respectively). Similarly, among the year 1 group grade goals were not correlated with GPA₂ ($r = .11$) while among the year 2 group grade goals were a strong positive correlate of GPA₂ ($r = .64$). As predicted, grade goals were also significantly related to PE₁ (year 1, $r = .31$; year 2, $r = .51$), PE₂ (year 1, $r = .32$; year 2; $r = .66$) and GPA₁ (year 1, $r = .35$; year 2; $r = .59$). Finally, as expected initial and subsequent performance at university (GPA₁/GPA₂) were strongly and positively associated ($r_s = .59$ and $.69$ for years 1 and 2 respectively). With the exception of the associations between performance-related cognitions and GPA₂ among the first year group, table 3 provides good initial support for the proposed mediation effects according to steps 1 and 2 of Barron and Kenny's (1986) criteria.

Modelling Performance among the Year 1 Group.

The proposed model of performance among the year 1 sample was tested first. As expected the direct path from achievement motivation ($\beta = .28$), to GPA₁ was statistically significant as was the path from C to achievement motivation ($\beta = .53$). However, contrary to expectation the path from PE₁ to GPA₁ was not statistically significant ($\beta = .15$) indicating that PE₁ does not partially mediate the influence of achievement motivation on initial performance among first years at university. To establish whether achievement motivation mediated the influence of C on initial performance we set the direct path from achievement motivation to GPA₁ to zero. In this model, the direct path from C to GPA₁ increased from .03 to .17 suggesting that achievement motivation fully mediated the relationship between C and GPA₁. Supporting this, a Sobel (1982) test examining the indirect effect of C on GPA₁ via achievement motivation was statistically significant ($Z = 4.28$, $p < .001$). A model in which all non significant paths were constrained to zero was subsequently estimated and fit the data well, $\chi^2(1, 172) = .37$, $p = .54$, NNFI = 1.02, CFI = 1.00, RMSEA = .00. In this model, shown

in figure 2, the path from achievement motivation ($\beta = .36$), to GPA_1 was significant ($p < .05$) and explained 13% of the variance while C predicted 28% of the variance in achievement motivation ($\beta = .53$).

Modelling Performance among the Year 2 Group

We next tested the proposed model among the year 2 group. As expected C significantly influenced context specific achievement motivation ($\beta = .58$) and in accordance with the mediation hypotheses the direct effects of C on PE_1 and GPA_1 were not significant (β s = $-.04$ and $-.04$, respectively). Achievement motivation was also a significant predictor of PE_1 at the situational level ($\beta = .29$) as well as a direct predictor of initial performance ($\beta = .41$) while PE_1 was a significant predictor of GPA_1 ($\beta = .24$).

Independently constraining the direct paths from achievement motivation to PE_1 and GPA_1 to zero led to a statistically significant increase in the path between C and GPA_1 (β increased from $-.04$ to $.19$) while the path increase from C to PE_1 (β increased from $-.04$ to $.13$ ns) did not reach a level of statistical significance. The indirect effect of C on GPA_1 via achievement motivation was also statistically significant ($Z = 2.94, p < .01$). Therefore these findings support the hypotheses that achievement motivation mediates the influence of C on GPA_1 . Additionally, constraining the path from PE_1 to GPA_1 to zero led to an increase in the path from, achievement motivation to GPA_1 (β increased from $.41$ to $.48$) indicating that PE_1 partially mediates the influence of achievement motivation on GPA_1 . Supporting this, the corresponding indirect effect was marginally statistically significant ($Z = 1.58, p = .06$).

PE_1 was a significant predictor of subsequent efficacy (PE_2) ($\beta = .54$) while GPA_1 significantly predicted PE_2 ($\beta = .39$) and GPA_2 ($\beta = .50$). Also as hypothesised, PE_2 ($\beta = .48$) and GPA_1 ($\beta = .32$) significantly predicted grade goals.

In order to test the hypotheses that grade goals partially mediate the influence of GPA_1 and PE_2 on GPA_2 we constrained the direct path from grade goal to GPA_2 to zero. This led to

an increase in the path from GPA₁ to GPA₂ (β increased from .50 to .62) indicating that grade goal partially mediates the influence of initial on subsequent performance. Supporting this, the indirect effect of GPA₁ on GPA₂ via grade goal was statistically significant ($Z = 2.37, p < .01$). The path from PE₂ to GPA₂ was not restored to statistical significance suggesting that PE₂ is not mediated by grade goals. However, after also constraining the direct path from GPA₁ to GPA₂ to zero, (in addition to the path from grade goal to GPA₂) the beta coefficient of the PE₂ /GPA₂ association increased from -.06 to .48 indicating that grade goals does mediate the influence of PE₂ on subsequent performance once the statistical control of past on future performance is released. Moreover, the indirect effect of PE₂ on GPA₂ via grade goals was statistically significant ($Z = 3.48, p < .001$). The model was re-estimated with all non-significant paths constrained to zero. This model fit the data well, $\chi^2(11, 77) = 3.72, p = .98$, NNFI = 1.06, CFI = 1.0, RMSEA = .00. In this model, shown in figure 3, achievement motivation ($\beta = .39$) and PE₁ ($\beta = .24$) explained 25% of the variance in GPA₁ while grade goals ($\beta = .35$) and GPA₁ ($\beta = .48$) explained 56% of the variance in GPA₂. C explained 33% ($\beta = .58$) of the variance in achievement motivation, and achievement motivation explained 7% ($\beta = .27$) of the variance in PE₁. Finally, a combination of GPA₁ ($\beta = .32$) and PE₂ ($\beta = .48$) explained 51% of the variance in grade goals.

Discussion

We examined hierarchical models of academic performance among separate groups of first and second year students at a UK university. Measures of conscientiousness, achievement motivation and performance related cognitions were included. The proposed hierarchical sequence was supported. The effect of C on initial performance (GPA₁) was fully mediated by achievement motivation in both groups providing evidence for the idea that personality traits have their influence on behavior through domain specific traits. Among the year 2 group the

effect of achievement motivation on initial performance (GPA_1) was partially mediated by initial performance efficacy. Moreover, grade goals fully mediated the influence of PE_2 on subsequent performance (GPA_2) and partially mediated the influence of initial performance (GPA_1) on subsequent GPA. Model differences between samples are consistent with neo-socioanalytic theory and goal theory. Specifically, performance-related cognitions are situational constructs that exhibit stability, and therefore predictive validity, only after relevant skills and experiences are acquired through feedback, that is, for the year 2 sample but not the year 1 group.

Our results provide prospective support for Richardson and Abraham's (2009) finding that the effect of C on GPA is mediated by achievement motivation in both year 1 and year 2 groups. Moreover, the alternative causal path from C to performance efficacy was not supported. This is consistent with research reporting a link between self efficacy and the personality trait neuroticism rather than C (e.g., Phillips et al. 2003). The strong prospective association ($r = .57$) between C and achievement motivation provides further support for the conceptualisation of achievement motivation as a trait-like, dispositional tendency, rather than a self regulatory motivational capacity. Moreover, the mediation of C on GPA by achievement motivation indicates a potential causal pathway of C on behaviour.

In line with neo-socioanalytic (Roberts & Wood, 2006), and goal (e.g., Locke & Latham, 1990) theories performance efficacy partially mediated the effect of achievement motivation on GPA and predicted the setting of higher grade goals among the second year group. Grade goals in turn were the most proximal psychological predictor of subsequent GPA and mediated and partially mediated the influence of performance efficacy and initial GPA on subsequent performance. Initial performance (GPA_1) and subsequent performance efficacy are closely related and both independently inform students' grade goals. Nonetheless, in a model that controlled for the influence of GPA_1 on GPA_2 only GPA_1 was mediated by grade goals. This finding is consistent with goal theory when GPA_1 is conceptualized as a statistical control for all

of the factors that influenced performance previously. However, it is also feasible, that initial performance has a causal role on grade goals and GPA_2 that is independent of past influences which may provide alternative explanations on how these mediation effects could be interpreted. Nonetheless research to date does not clarify this issue.

Performance efficacy and grade goals did not contribute towards the model among the first year group. We believe this is due to insufficient feedback on the global GPA criterion among the year 1 group. Specifically, we speculate that the first year group had not received enough performance feedback relating to GPA scores to inform the stability (and predictive utility) of self-regulatory motivational beliefs involving broad performance outcomes such as global GPA composites awarded at the end of each year. Indeed, at time 2 participants in the year 1 group had not taken their end of year 1 examinations and at time 4, they had only their end of year 1 results, which do not contribute towards final degree marks and may not be seen as particularly important. This coincides with normative values in the UK that see the first year at university as a time for students to adjust to their new environment and enjoy their independence from home (rather than as a time for performance). By contrast, at time 2, those in the second year group had completed almost two years of university and by time 4 had received approximately 40% of their marks that contributed towards their overall degree assessment. This speculation is consistent with goal theory, which maintains that relevant feedback is central to the formation and stability of goal and efficacy beliefs (Locke & Latham, 1990).

Interestingly, initial performance (GPA_1) among the first year group (which does not contribute towards final degree assessments) was unrelated to subsequent performance efficacy (PE_2) yet among the year 2 group an association of $r = .56$ was obtained. However, GPA_1 was the strongest predictor of GPA_2 in both samples suggesting that students early on in their degrees fail to optimally cognise reliable performance feedback that is available to them.

Among the first year group, achievement motivation, accounted for 13% of the variance in GPA₁ while C accounted for 28% of the variance in achievement motivation. Among second years, achievement motivation, and performance efficacy explained 25% of the variance in GPA₁ while grade goals and GPA₁ explained 56% of the variance in GPA₂. These findings indicate that C and achievement motivation could facilitate the prediction of global performance outcomes early on in students' career while goal setting and performance efficacy were more useful during the later stages of university. Nonetheless, grade goal and efficacy constructs could be operationalised at more narrow levels of abstraction such as task or test scores and although likely to be less stable over time they could facilitate the identification of "at risk" students over shorter time periods and during the earlier stages of students' careers. However, it's important to note that performance is only one of many relevant outcomes at university. For example, interest in learning, satisfaction and social integration are arguably of equal importance and could be considered along side such performance criteria.

GPA is a cumulative outcome based on numerous study behaviors performed over time and it could be argued that interventions should focus on short-term study behaviors such as time spent studying and lecture attendance. However, reported hours studied appear to be unrelated to, or weakly associated with GPA (*rs* range from -.02 to .12), regardless of the type of achievement (e.g., cumulative GPA or course GPA) and measures (e.g., number of hours studied or time diary) employed (Shuman, Walsh, & Olson, 1985). Consequently, it is difficult to interpret self reported study time data and increasing time spent studying is an unpromising target for interventions designed to boost GPA

Based on the present findings, it would be interesting to see whether one-off, goal setting and/or efficacy interventions focused on performance outcomes could boost academic performance. Recent research suggests that personality traits, and especially lower-level

dispositions may be malleable (e.g., Mroczek & Spiro, 2003; Roberts & Wood, 2006) making achievement motivation a potentially useful target for study skill interventions. Overall then, while previous research has suggested that multifaceted interventions are likely to be most effective (Hattie, Biggs & Purdie, 1996) the present findings imply that it would be worth testing one-off interventions designed to improve study skills, especially achievement motivation, and to bolster motivation through performance goal-setting and enhancement of performance self-efficacy. Behavior change techniques found to be effective in other domains (such as goal setting, goal review, self monitoring, task analysis, envisioning success, and implementation intention formation) could be employed (Cervone, 1989; Gollwitzer & Sheeran, 2006; Michie, Abraham, Whittington, McAteer & Gupta, in press). Delivering such interventions earlier and later in students' careers with long-term evaluative follow up would be especially informative.

One strength of the present studies is that the relationships tested were separated by time in a meaningful way that was consistent with the theoretical hypotheses. With the exception of the paths between achievement motivation and PE₁, and PE₂ and grade goals all relationships were modelled prospectively. We acknowledge however, that our samples comprised more females, more high achieving students, and students with psychological profiles more suited to achievement at University. Consequently, the samples are unlikely to be representative of the student population which may limit the generalisation of these findings. It seems reasonable however to speculate that the restricted sample range is likely to have reduced the variation in scores and led to more conservative estimates than those in the populations from which they were drawn. In any case our findings are consistent with those reported in other domains including industrial/organizational settings (Locke & Latham, 1990). Future research is needed to establish whether hierarchical models of motivation have validity across institutions, and different groups of students (including

gender groups, different ability groups and races) and after controlling for intelligence.

However, experimental manipulation of the causal relationships in carefully-designed interventions testing mediation is required to validate these findings.

In conclusion, we examined a hierarchically based theoretical model of academic achievement that comprised the most salient correlates of GPA. The findings are consistent with the idea that more global and more invariant personality traits have their impact on performance through more situational performance specific cognitions. Neo-socioanalytic provides a theoretical framework for combining the most salient predictors of GPA in one model as well as highlighting potential motivational mechanisms that drive academic achievement. This is important, as there are many overlapping predictors of GPA in the literature and little understanding on how these can be integrated. Further research could focus on the development and evaluation of theory-based interventions designed to enhance academic performance among students with relatively weaker scores on these predictive characteristics.

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Table 1

Breakdown of the gender and age characteristics by entry cohort at each time point of the study.

entry year	Time 1		Time 2		Time 3		Time 4		Time 5		
	06	05	06	05	06	05	06	05	06	05	
Male	<i>N</i>	152	109	54	29	35	22	22	18	13	13
%		(26%)	(27%)	(23%)	(18%)	(20%)	(17%)	(19%)	(18%)	(16%)	(17%)
Female		428	301	184	129	137	105	96	83	69	64
<i>N</i> %		(74%)	(73%)	(77%)	(82%)	(80%)	(83%)	(81%)	(82%)	(84%)	(83%)
Age		20.02	20.98	20.09	21.25	21.05	21.09	20.83	21.82	20.86	21.64
Mean(SD)		4.46	4.72	4.52	5.94	4.72	5.87	6.10	7.17	6.00	6.91

Note. Discrepancies between *N*s for the total samples and gender breakdown are due to participants who did not report their gender.

Table 2

Means, Standard Deviations and Cronbach's Alphas of study measures

Measures	No of items	Year 1 sample					Year 2 sample				
		Range minimum	Range maximum	Mean	(SD)	α	Range minimum	Range maximum	Mean	(SD)	α
GPA ₁	1	35.60	88.80	65.62	7.12	N/A	31.60	93.20	62.77	7.34	N/A
GPA ₂	1	35.25	81.43	64.22	7.04	N/A	44.73	79.10	65.37	6.13	N/A
AM	8	1.75	5.00	3.70	.62	.82	2.00	5.00	3.65	.61	.81
PE ₁	4	.00	9.00	6.68	1.42	.79	1.80	9.00	6.66	1.45	.89
PE ₂	4	2.33	9.00	6.96	1.33	.83	2.20	9.00	6.81	1.52	.87
Grade goal	1	.50	.70	.62	.05	N/A	.40	.75	.62	.05	N/A

Note. GPA₁= initial grade point average, GPA₂= subsequent grade point average, PE₁= performance efficacy measured at time 2, PE₂= performance efficacy measured at time 4, Among the year 1 group $N = 172$ for GPA₁, $N = 82$ for GPA₂, $N = 566$ for conscientiousness, $N = 240$ for achievement motivation, $N = 238$ for PE₁, $N = 122$ for PE₂, $N = 118$ for grade goals; Among the year 2 group $N = 323$ for GPA₁, $N = 257$ for GPA₂, $N = 406$ for conscientiousness, $N = 158$ for achievement motivation and PE₁, $N = 100$ for PE₂ and $N = 101$ for grade goals.

Table 3

Correlations among conscientiousness, achievement motivation, performance efficacy, grade goals and performance.

	1.	2.	3.	4.	5.	6.	7.
1. GPA ₁	0	.59**	.24**	.36**	.29**	.09	.35**
2. GPA ₂	.69**	0	.04	.16	-.03	-.01	.11
3. Conscientiousness	.22*	.16	0	.57**	.30**	.11	.30**
4. AM	.39**	.38**	.57**	0	.41**	.26*	.33**
5. PE ₁	.36**	.36**	.23**	.37**	0	.67**	.31**
6. PE ₂	.56**	.47**	.19	.34**	.70**	0	.32**
7. Grade goals	.59**	.64**	.24*	.36**	.51**	.66**	0

Note. correlations in upper triangle are for the year 1 sample and in the lower triangle for the 2nd year sample, GPA₁= initial grade point average, GPA₂ = subsequent grade point average; AM =achievement motivation; PE₁ = performance efficacy measured at time 2; PE₂ = performance efficacy measured at time 4, $N = 172$ and 128 for first and second year correlations respectively including GPA₁, conscientiousness, achievement motivation, & PE₁, $N = 82$ and 77 respectively for year 1 and year 2 correlations including measures of for GPA₂, PE₂, & grade goals. * $p < .05$, ** $p < .01$, *** $p < .001$, ^m $-p < .09$

Time 1 (October, 2006) Time 2 (May, 2007) Time 2 (May, 2007) Time 3 (July, 2007) Time 4 (October, 2007) Time 4 (October, 2007) Time 5 (July, 2008)

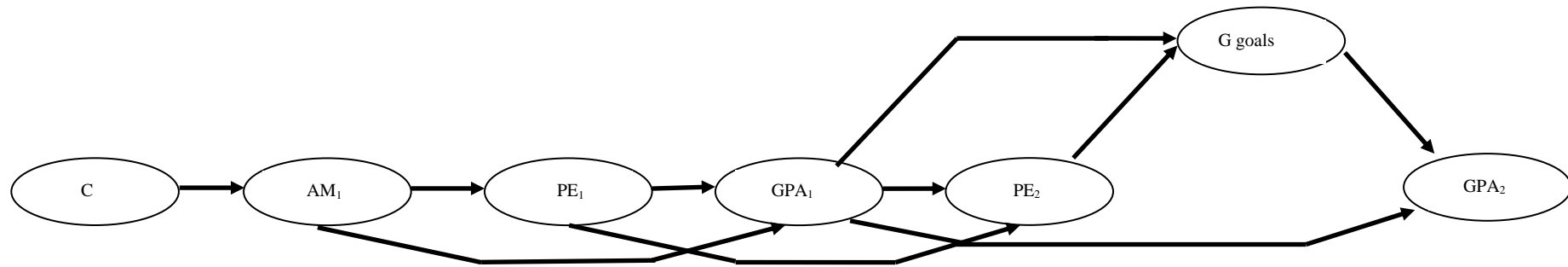
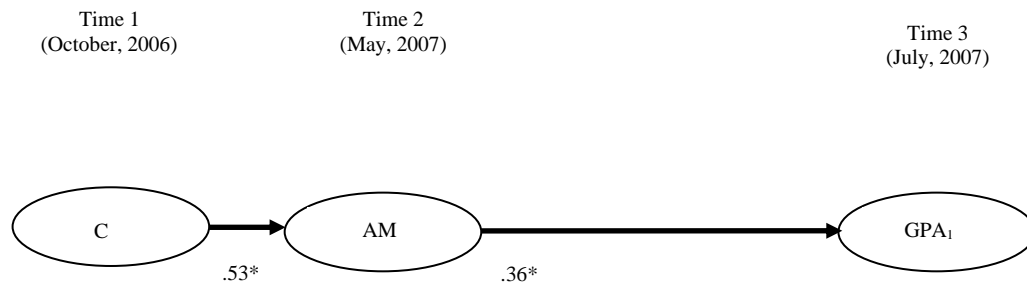


Figure 1. Proposed Hierarchical Model of Academic Performance

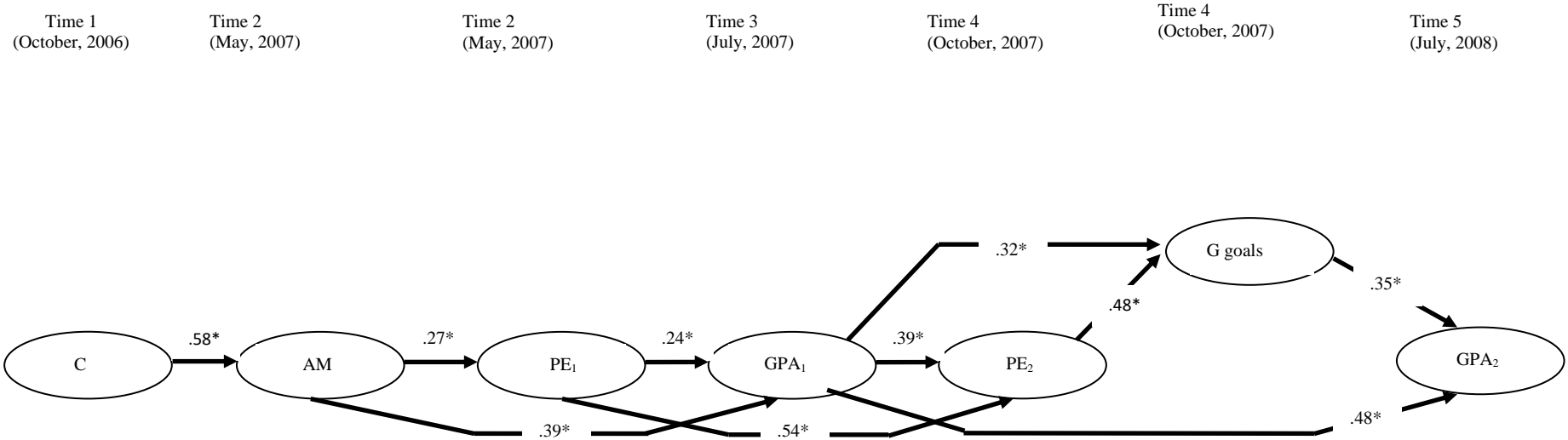
Note. C = conscientiousness, AM = achievement motivation, PE₁ = performance efficacy measured at time 2, GPA₁= initial grade point average, PE₂ = performance efficacy measured at time 4, G goals = grade goals, GPA₂ = grade point average measured at time 2.



$\chi^2(1, 172) = .37, p = .54, CFI = 1.00, NNFI = 1.02, RMSEA = .00.$

Figure 2. Hierarchical Motivational Sequence of Academic Performance among First Year Students

Note. Values represent standardised beta coefficients; covariance among the exogenous variables is not shown; C = conscientiousness; AM = achievement motivation; GPA₁=initial grade point average; RMSEA = root-mean-square error of approximation; NNFI= non-normed fit index; CFI = comparative fit index. * $p < .05$.



$\chi^2(11, 77) = 3.72, p = .98, CFI = 1.0, NNFI = 1.06, RMSEA = .00$

Figure 3. Proposed Hierarchical Model of Academic Performance among Second Year University Students

Note. values represent standardised beta coefficients; covariance among the exogenous variables are not shown; C = conscientiousness, AM =achievement motivation, PE₁ = performance efficacy measured at time 2, PE₂ = performance efficacy measured at time 4, GPA₁= initial grade point average, g goals = grade goals, GPA₂ = subsequent grade point average, RMSEA=root-mean-square error of approximation; NNFI=non-normed fit index; CFI=comparative fit index. * $p < .05$.