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Psychological Correlates of University Students' Academic Performance: A Systematic Review and Meta-Analysis

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A review of 13 years of research into antecedents of university students' grade point average (GPA) scores generated the following: a comprehensive, conceptual map of known correlates of tertiary GPA; assessment of the magnitude of average, weighted correlations with GPA; and tests of multivariate models of GPA correlates within and across research domains. A systematic search of PsycINFO and Web of Knowledge databases between 1997 and 2010 identified 7,167 English-language articles yielding 241 data sets, which reported on 50 conceptually distinct correlates of GPA, including 3 demographic factors and 5 traditional measures of cognitive capacity or prior academic performance. In addition, 42 non-intellective constructs were identified from 5 conceptually overlapping but distinct research domains: (a) personality traits, (b) motivational factors, (c) self-regulatory learning strategies, (d) students' approaches to learning, and (e) psychosocial contextual influences. We retrieved 1,105 independent correlations and analyzed data using hypothesis-driven, random-effects meta-analyses. Significant average, weighted correlations were found for 41 of 50 measures. Univariate analyses revealed that demographic and psychosocial contextual factors generated, at best, small correlations with GPA. Medium-sized correlations were observed for high school GPA, SAT, ACT, and A level scores. Three non-intellective constructs also showed medium-sized correlations with GPA: academic self-efficacy, grade goal, and effort regulation. A large correlation was observed for performance self-efficacy, which was the strongest correlate (of 50 measures) followed by high school GPA, ACT, and grade goal. Implications for future research, student assessment, and intervention design are discussed.

Keywords: student, grade point average, self-efficacy, goal, meta-analysis

The psychology of individual differences originated in attempts to predict scholastic performance. Binet and Simon's (1916) work showed that children's individual cognitive capacities explained variability in educational performance and, in doing so, laid the foundations for extensive research into intelligence and intelligence testing (Neisser et al., 1996). Theoretical debate focused on the psychological nature of intelligence, and applied research explored how differences in intelligences can be most usefully assessed (e.g., Carpenter, Just, & Shell, 1990; Gardner, 1983; Spearman, 1927). Subsequent research has identified a variety of individual differences that predict scholastic performance and prompted construction of a wide range of assessment instruments. Yet this diverse literature has not clarified how and to what extent separate measures of academic potential are related. Greater conceptual and methodological integration would help focus future research questions and facilitate optimal assessment of students' academic potential. In order to achieve this objective we reviewed 13 years of research into correlates of tertiary-level academic performance, where "tertiary-level" refers to postsecondary, undergraduate university, or college education. We investigated (a) which individual differences are associated with better performance, (b) how strong these associations are, and (c) whether a parsimonious evidence-based, additive model of predictors can be constructed.

Distinct strands of evidence indicate that predictions of academic performance may be more accurate if they are based on assessment of a variety of individual differences, not just of past achievement and cognitive capacity. First, in tertiary education, student selection procedures reduce variation in intelligence scores, especially at selective institutions (Furnham, Chamorro-Premuzic, & McDougall, 2002). Consequently, at this level, factors others than intelligence may be critical to accurate prediction of performance. Second, and more generally, research has identified a variety of non-intellective factors

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associated with academic performance. For example, Ackerman and Heggestad (1997) provided an informative analysis of relationships between intelligence, personality, and interests; Poropat (2009) demonstrated that academic performance is associated with five-factor personality traits. The latter review showed that the relation between conscientiousness and academic performance was largely independent of intelligence and that when academic performance at secondary level (i.e., high school) was controlled, conscientiousness added as much to the prediction of tertiary academic performance as did intelligence. Less stable tendencies including motivation, self-regulatory learning strategies, and learning styles have also been found to predict academic performance, controlling for the effects of intelligence and personality (e.g., Chamorro-Premuzic, & Furnham, 2008; for a review, see Robbins et al., 2004).

In addition, traditional tests of cognitive ability have limitations. Following the construction of the Stanford–Binet intelligence test (Terman, 1916), the Scholastic Aptitude Test was developed in 1925. This test is now referred to as the SAT and is the most widely used, standardized, college admissions test in North America (Everson, 2002). Yet, doubts have been raised regarding cultural and socioeconomic biases in the SAT and, in a more recent test of academic reasoning, the ACT (e.g., Zwick, 2004). In combination, these findings suggest that development of comprehensive, accurate, predictive models of academic performance necessitates a broader representation of student capacities and tendencies. We aimed to provide a foundation for such work by presenting an integrative overview of the evidence supporting a wide range of predictors of tertiary educational performance. Our research focused on individual differences that have the potential to enhance the prediction of academic performance over and above levels achieved by traditional measures of intelligence or cognitive capacity.

Measuring Student Performance

Predicting performance depends on being able to assess it. Tertiary (i.e., undergraduate university) students' performance is usually expressed in terms of grade point average (GPA), that is, the mean of marks from weighted courses contributing to assessment of the final degree. GPA is the key criterion for postgraduate selection and graduate employment and is predictive of occupational status (Strenze, 2007). As such, it is an index of performance directly relevant to training and employment opportunities (Plant, Ericsson, Hill, & Asberg, 2005) and is meaningful to students, universities, and employers alike. GPA is also an objective measure with good internal reliability and temporal stability (e.g., Bacon & Bean, 2006; Kobrin, Patterson, Shaw, Mattern, & Barbuti, 2008). GPA is not without limitations, with questions of reliability and validity arising as a result of grade inflation (Johnson, 2003) and institutional grading differences (Didier, Kreiter, Buri, & Solow, 2006). Nonetheless, no other measure of tertiary academic performance rivals the measurement utility of GPA. For example, behavioral measures such as time spent studying appear to be unrelated to or weakly associated with GPA (*r*s range from −.02 to .12), regardless of assessment method (e.g., number of hours studied or time diaries; Hill, 1990; Schuman, Walsh, & Olson, 1985) or performance criterion (e.g., cumulative GPA or course GPA). Unsurprisingly then, GPA is the most widely studied measure of tertiary academic performance, which we used as the primary outcome measure in this study.

Traditional Correlates of GPA: SAT, ACT, Intelligence, High School GPA, and A Level Points

Measures of SAT, ACT (originally the abbreviation of American College Testing), and high school GPA are central to university admissions in North America. Test developers conceptualized the SAT as a test of scholastic aptitude, and concordance studies show that the SAT and ACT are highly correlated (Dorans, Lyu, Pommerich, & Houston, 1997). There is considerable conceptual and empirical overlap between these measures of scholastic aptitude and more general measures of intelligence (e.g., Raven's Advanced Progressive Matrices; Frey & Detterman, 2004; Raven, Raven, & Court, 1998). Surprisingly, however, studies have not included measures of intelligence together with SAT/ACT assessments when predicting GPA, making it difficult to determine whether these scholastic assessments add to, or substitute for, the predictive power of intelligence tests in relation to academic performance.

Despite differences in course content and grading criteria, high school GPA is a stronger predictor of university GPA than is either the SAT or the ACT. All three measures have been found to explain independent variation in GPA (Bridgeman, Pollack, & Burton, 2004; Ramist, Lewis, & McCamley-Jenkins, 2001), collectively accounting for approximately 25% of the variance (Mathiasen, 1984; Mouw & Khanna, 1993; Robbins et al., 2004). Hence, substantial variance is unexplained.

In Europe, there is no standardized university admission procedure (equivalent to SAT/ACT), but assessment of secondary school performance is normally central to student selection. In the United Kingdom, for example, the advanced general certificate of education (A level examinations) is usually taken at age 18 and is equivalent to high school GPA. The number of cross-subject A level points attained is the key entry criterion for most U.K. universities. A weighted mean *r* of .28 between A level points and degree classification has been reported (Peers & Johnston, 1994), although few studies of this relation have been conducted recently.

We refer to such established measures of academic potential and cognitive ability as "traditional" correlates of GPA to indicate that the incremental predictive utility of other (non-intellective) factors should be demonstrated while controlling for these widely used assessments. Thus, in the model tested here, we included five traditional correlates of GPA: SAT, ACT, intelligence, high school GPA, and A level points.

Psychological Correlates of GPA: A Brief Overview

Intelligence tests (e.g., Harris, 1940; Neisser et al., 1996) reflect cognitive capacities, including the ability to represent and manipulate abstract relations (Carpenter et al., 1990). Such measures assess what an individual can do. Other correlates of GPA may clarify how individuals are likely to use their intellectual capacities (Barrick, Mount, & Strauss, 1993; Busato, Prins, Elshout, & Hamaker, 1998). Identification of such non-intellective antecedents of academic performance has proliferated over the past 10–15 years (e.g., Eccles & Wigfield, 2002). We review this research

across 13 years (1997–2010), presenting a five-domain framework within which nontraditional correlates of GPA can be organized.

Many studies have assessed the role of personality in academic performance (Poropat, 2009). Dispositional personality traits are assumed, like intelligence, to exert a constant influence over performance across situations. Such traits are, in part, genetically mediated and remain relatively stable over time (for a conceptual review, see Murphy & Alexander, 2000). For example, intelligence scores have heritability estimates ranging from .50 to .80 (Plomin, 2001); parallel estimates of .72 have been reported for conscientiousness (Riemann, Angleitner, & Strelau, 1997).

Research has also highlighted the importance of domain-specific, motivational contributions to academic performance (Pintrich, 2004). Such research demonstrates that performance-relevant beliefs, values, and goals are "dynamic and contextually bound and that learning strategies can be learned and brought under the control of the student" (Duncan & McKeachie, 2005, p. 117). As Zimmerman (1989) noted, self-regulated learners are "meta-cognitively, motivationally, and behaviourally active participants in their own learning process" (p. 4). Consequently, models of academic performance may have to encompass expectancies, motivation, goals, and use of self-regulatory learning strategies (Eccles & Wigfield, 2002; Robbins et al., 2004). Unlike intelligence and personality, these predictors are more malleable and context sensitive (e.g., Carver & Scheier, 1981; Wolters, Pintrich, & Karabenick, 2003).

Research into students' approaches to learning (SAL; e.g., Biggs, 1987), developed using phenomenological methods, has acknowledged the impact of motivational and cognitive processes on learning (e.g., Diseth, Pallesen, Brunborg, & Larsen, 2010). Such research has resulted in overarching characterizations of students' learning styles (e.g., surface vs. deep) that imply particular constellations of motivation and self-regulatory control. In practice, however, students' performance may depend on changing combinations of motives and self-regulatory strategies across different tasks and contexts (Pintrich, 2004). Consequently, constructs drawn from motivational and self-regulatory research may facilitate more detailed and flexible characterizations of predictors of scholastic performance than SAL categorizations.

In addition, academic performance may be determined by organizational features of learning institutions and the interaction between individual learners and their learning context (Bean, 1980; Tinto, 1975). Tinto's work highlighted the role of institutional characteristics in shaping students learning and reducing student dropout, and later models (e.g., Bean, 1985) emphasized the mediating role of psychological responses to contextual influences in optimizing academic performance. In general, institutional characteristics and contextual influences have been assessed in terms of learners' perceptions of their environment and their psychological responses to learning contexts.

In order to clarify which non-intellective factors are most useful in understanding academic performance we will consider constructs from five research domains: (a) personality traits, (b) motivational factors, (c) self-regulatory learning strategies, (d) students' approaches to learning, and (e) psychosocial contextual influences (see Table 1). Table 2 presents illustrative items used to measure each of the constructs listed in Table 1.

Personality Traits

The orthogonal personality dimensions included in the five-factor model represent the most comprehensive and widely applied approach to conceptualizing and assessing personality (i.e., conscientiousness, extraversion, neuroticism, openness, and agreeableness; Costa & McCrae, 1992). All five traits, and especially conscientiousness, have been found to predict GPA (for a review, see Poropat, 2009). Measures of conscientiousness assess the extent to which individuals are dependable (e.g., organized) and achievement oriented (e.g., ambitious). Those high in conscientiousness are expected to be more motivated to perform well (Mount & Barrick, 1995) and to be more persistent when faced with difficult or challenging course materials.

Procrastination (Lay, 1986) is typically defined as a behavioral tendency to postpone tasks or decision making (Milgram, Mey-Tal, & Levison, 1998; van Eerde, 2003), which personality theorists have attributed to deficient impulse control (Mischel, Shoda, & Peake, 1988). Steel (2007) has argued that procrastination is a central facet of conscientiousness (in a negative direction) and is indicative of self-regulatory limitations. Consequently, students high in procrastination are likely to achieve less because, like those

Table 1
Non-Intellective Correlates of GPA Grouped by Distinct Research Domains

Personality traits	Motivation factors	Self-regulatory learning strategies	Students' approach to learning	Psychosocial contextual influences
Conscientiousness	Locus of control	Test anxiety	Deep	Social integration
Procrastination	Pessimistic attributional style	Rehearsal	Surface	Academic integration
Openness	Optimism	Organization	Strategic	Institutional integration
Neuroticism	Academic self-efficacy	Elaboration		Goal commitment
Agreeableness	Performance self-efficacy	Critical thinking		Social support
Extraversion	Self-esteem	Metacognition		Stress (in general)
Need for cognition	Academic intrinsic motivation	Effort regulation		Academic stress
Emotional intelligence	Academic extrinsic motivation	Help seeking		Depression
	Learning goal orientation	Peer learning		
	Performance goal orientation	Time/study management		
	Performance avoidance goal orientation	Concentration		
	Grade goal			

Table 2
Categorization of Measures Included in the Meta-Analyses

Construct	Definition/attributes, representative measures, and representative items
	Personality traits[a]
Conscientiousness	Attributes: self-disciplined and achievement oriented. Representative measure(s): NEO Personality Inventory–Revised (Costa & McCrae, 1992), Big Five Inventory (John et al., 1991), Cattell 16 Personality Factor (Cattell et al., 1993), Trait Descriptive Adjectives (Goldberg, 1992), Big Five Inventory (Benet-Martínez & John, 1998), Resource Associates' Adolescent Personal Style Inventory for college students (Lounsbury et al., 2004), Form E of Jackson's (1984) Personality Research Form, general achievement motivation subscale from the International Personality Item Pool (Goldberg, 1999), work mastery subscale from the Work and Family Orientation Questionnaire (Spence & Helmreich, 1983). Representative item(s): see Benet-Martínez & John (1998)
Procrastination	Definition: a general tendency to delay working on tasks and goals. Representative measure(s): General Procrastination Scale (Lay, 1986). Representative item(s): "I generally delay before starting on work I have to do"
Openness	Attributes: imaginative, insightful, intellectually curious, and openness to new experiences. Representative measure(s): see personality inventories listed for conscientiousness. Representative item(s): see Benet-Martínez & John (1998)
Neuroticism	Attributes: anxious, depressed, inability to delay gratification, and increased vulnerability to stressors in the environment. Representative measure(s): Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975), negative affect from the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988); see too personality inventories listed for conscientiousness. Representative item(s): see Benet-Martínez & John (1998)
Agreeableness	Attributes: trusting, empathetic, and compliant in social situations. Representative measure(s): see personality inventories listed for conscientiousness. Representative item(s): see Benet-Martínez & John (1998)
Extraversion	Attributes: assertive, positive, and sociable. Representative measure(s): EPQ (Eysenck & Eysenck, 1975), positive affect from the PANAS (Watson et al., 1988); see too personality inventories listed for conscientiousness. Representative item(s): see Benet-Martínez & John (1998)
Need for cognition	Definition: a general tendency to enjoy activities that involve effortful cognition. Representative measure(s): typical intellectual engagement (Goff & Ackerman, 1992), need for cognition (Cacioppo et al., 1984). Representative item(s): "I would prefer complex to simple problems"
Emotional intelligence	Definition: capacity to accurately perceive emotion in self and others. Representative measure(s): Emotional Quotient Short Form (Bar-On, 2002), Toronto Alexithymia Scale (Bagby et al., 1994), Mayer–Salovey–Caruso Emotional Intelligence Test (Mayer et al., 2002). Representative item(s): see Schutte et al. (1988)
	Motivation factors[b]
Locus of control	Definition: perceived control over life events and outcomes. Representative measure(s): locus of control (Levenson, 1974), Rotter Internal–External Locus of Control Scale (Rotter, 1966). Representative item(s): see Rotter (1966)
Pessimistic attributional style	Definition: perceived control over negative life events and outcomes. Representative measure(s): Academic Attributional Style Questionnaire (Peterson & Barrett, 1987). Representative item(s): Students are presented with 12 negative academic situations (e.g., "you fail a final exam") and asked to identify and rate the cause on three dimensions: internal vs. external, stable vs. unstable, global vs. specific. Pessimistic attributional style is represented by internal, stable, and global ratings (higher scores).
Optimism	Definition: general beliefs that good things will happen. Representative measure(s): Revised Life Orientation Test (Scheier et al., 1994). Representative item(s): "In uncertain times, I usually expect the best"
Academic self-efficacy	Definition: general perceptions of academic capability. Representative measure(s): academic self-confidence subscale from the Student Readiness Inventory (Le et al., 2005), academic control (Perry et al., 2001), academic self-concept (Reynolds et al., 1980). Representative item(s): "I have a great deal of control over my academic performance in my courses"
Performance self-efficacy	Definition: perceptions of academic performance capability. Representative measure(s): performance capability (Shell & Husman, 2001). Representative item(s): "What is the highest GPA that you feel completely certain you can attain?"
Self-esteem	Definition: general perceptions of self-worth. Representative measure(s): Rosenberg (1965), self-liking scale (Pinel et al., 2005). Representative item(s): "I feel that I have a number of good qualities"
Academic intrinsic motivation	Definition: self-motivation for and enjoyment of academic learning and tasks. Representative measure(s): autonomous motivation (Sheldon & Elliot, 1998), academic intrinsic motivation (Vallerand & Bissonnette, 1992), task value subscale from the Motivation Strategies for Learning Questionnaire (MSLQ; Pintrich & DeGroot, 1990). Representative item(s): "Striving because of the fun and enjoyment which the goal provides you. While there may be many good reasons for the goal, the primary 'reason' is simply your interest in the experience itself"

Table 2 *(continued)*

Construct	Definition/attributes, representative measures, and representative items
Academic extrinsic motivation	Definition: learning and involvement in academic tasks for instrumental reasons (e.g., to satisfy others' expectations). Representative measure(s): academic extrinsic motivation (Vallerand & Bissonnette, 1992), controlled motivation (Sheldon & Elliot, 1998). Representative item(s): "Striving because somebody else wants you to or thinks that you ought to, or because you'll get something from somebody if you do. That is, you probably wouldn't strive for this if you didn't get some kind of reward, praise or approval for it"
Learning goal orientation	Definition: learning to develop new knowledge, mastery, and skills. Representative measure(s): Button et al. (1996); Elliot & Church (1997); Harackiewicz et al. (1997); Roedel et al. (1994); Vandewalle (1997); intrinsic learning subscale from the MSLQ (Pintrich & DeGroot, 1990). Representative item(s): "I want to learn as much as possible in this class," "In a class like this, I prefer course material that really challenges me so I can learn new things"
Performance goal orientation	Definition: achievement striving to demonstrate competence relative to others. Representative measure(s): Button et al. (1996); Elliot & Church (1997); Harackiewicz et al. (1997); Roedel et al. (1994); Vandewalle (1997); extrinsic motivation subscale from the MSLQ (Pintrich & DeGroot, 1990). Representative item(s): "I want to do well in this class to show my ability to my family, friends, advisors, or others," "I am motivated by the thought of outperforming my peers in this class"
Avoidance goal orientation	Definition: avoidance of learning activities that may lead to demonstration of low ability and achievement. Representative measure(s): Button et al. (1996); Elliot & Church (1997); Harackiewicz et al. (1997); Roedel et al. (1994); Vandewalle (1997). Representative item(s): "My fear of performing poorly in this class is often what motivates me," "I just want to avoid doing poorly in this class"
Grade goal	Definition: self-assigned minimal goal standards (in this context, GPA). Representative measure(s): self-assigned goals (Locke & Latham, 1990), grade expectation (Lane & Gibbons, 2007). Representative item(s): "What is the minimum (i.e., the least you would be satisfied with) percentage grade goal for the next test (on a scale of 0% to 100%)?"
	Self-regulatory learning strategies
Test anxiety	Definition: negative emotionality relating to test-taking situations. Representative measure(s): State–Trait Anxiety Inventory (Spielberger et al., 1970), test anxiety subscale from the MSLQ (Pintrich & DeGroot, 1990), anxiety subscale from the Learning and Study Strategy Inventory (LASSI; Weinstein et al., 1987). Representative item(s): see http://www.hhpublishing.com/_assessments/LLO/scales.html and Credé & Phillips (2011)
Rehearsal	Definition: learning through repetition. Representative measure(s): rehearsal subscale from the MSLQ (Pintrich & DeGroot, 1990). Representative item(s): see Credé & Phillips (2011)
Organization	Definition: capacity to select key pieces of information during learning situations. Representative measure(s): selecting main ideas subscale from the LASSI (Weinstein et al., 1987), organization subscale from the MSLQ (Pintrich & DeGroot, 1990). Representative item(s): see http://www.hhpublishing.com/_assessments/LLO/scales.html and Credé & Phillips (2011)
Elaboration	Definition: capacity to synthesize information across multiple sources. Representative measure(s): information processing subscale from the LASSI (Weinstein et al., 1987), elaboration subscale from the MSLQ (Pintrich & DeGroot, 1990). Representative item(s): see http://www.hhpublishing.com/_assessments/LLO/scales.html and Credé & Phillips (2011)
Critical thinking	Definition: capacity to critically analyze learning material Representative measure(s): critical thinking subscale from the MSLQ (Pintrich & DeGroot, 1990). Representative item(s): see Credé & Phillips (2011)
Metacognition	Definition: capacity to self-regulate comprehension of one's own learning. Representative measure(s): self-testing subscale from the LASSI (Weinstein et al., 1987), metacognition subscale from the MSLQ (Pintrich & DeGroot, 1990). Representative item(s): see http://www.hhpublishing.com/_assessments/LLO/scales.html and Credé & Phillips (2011)
Effort regulation	Definition: persistence and effort when faced with challenging academic situations. Representative measure(s): motivation subscale from the LASSI (Weinstein et al., 1987), work drive (Lounsbury & Gibson, 2002), effort regulation subscale from the MSLQ (Pintrich & DeGroot, 1990). Representative item(s): see http://www.hhpublishing.com/_assessments/LLO/scales.html and Credé & Phillips (2011)
Help seeking	Definition: tendency to seek help from instructors and friends when experiencing academic difficulties. Representative measure(s): seeking help from teacher (Larose & Roy, 1995), assistance from peers (Larose & Roy, 2005), help seeking subscale from the MSLQ (Pintrich & DeGroot, 1990). Representative item(s): see Credé & Phillips (2011)
Peer learning	Definition: tendency to work with other students in order to facilitate one's learning. Representative measure(s): peer learning subscale from the MSLQ (Pintrich & DeGroot, 1990). Representative item(s): "I try to work with other students from this class to complete the course assignments"
Time/study management	Definition: capacity to self-regulate study time and activities. Representative measure(s): time management subscale from the LASSI (Weinstein et al., 1987), time/study environmental management subscale from the MSLQ (Pintrich & DeGroot, 1990). Representative item(s): see http://www.hhpublishing.com/_assessments/LLO/scales.html and Credé & Phillips (2011)

(table continues)

Table 2 *(continued)*

Construct	Definition/attributes, representative measures, and representative items
Concentration	Definition: capacity to remain attentive and task focused during academic tasks. Representative measure(s): quality of attention (Larose & Roy, 1995), concentration subscale from the LASSI (Weinstein et al., 1987). Representative item(s): see http://www.hhpublishing.com/_assessments/LLO/scales.html
	Student approaches to learning
Deep approach to learning	Definition: combination of deep information processing and a self (intrinsic) motivation to learn. Representative measure(s): Approaches to Studying Inventory (Entwistle & Ramsden, 1983), Study Process Questionnaire (Biggs, 1987). Representative item(s): see Fox et al. (2001)
Surface approach to learning	Definition: combination of shallow information processing and an extrinsic motivation to learn. Representative measure(s): see measures listed for deep approach to learning. Representative item(s): see Fox et al. (2001)
Strategic approach to learning	Definition: task-dependent usage of deep and surface learning strategies combined with a motivation for achievement. Representative measure(s): See measures listed for deep approach to learning. Representative item(s): see Fox et al. (2001)
	Psychosocial contextual influences
Social integration	Definition: perceived social integration and ability to relate to other students. Representative measure(s): interaction with peers (Roberts & Clifton, 1992), social integration (Baker & Siryk, 1984; Cabrera et al., 1993), social activity (Le et al., 2005). Representative item(s): "I find it easy to get to know other people"
Academic integration	Definition: perceived support from professors. Representative measure(s): interaction with professors (Roberts & Clifton, 1992), academic integration (Mannan, 2001). Representative item(s): "Professors take a personal interest in helping me with my work"
Institutional integration	Definition: commitment to the institution. Representative measure(s): academic integration (Pascarella & Terenzini, 1979), social connection (Le et al., 2005), institutional commitment (Baker & Siryk, 1984), College Adaptation Questionnaire (Crombag, 1968). Representative item(s): "I am confident that I made the right decision in choosing to attend this university"
Goal commitment	Definition: commitment to staying at university and obtaining a degree. Representative measure(s): College Student Inventory (Noel & Levitz, 1993), commitment to college (Le et al., 2005). Representative item(s): see Allen (1999) & Le et al. (2005)
Social support	Definition: availability of social support from family members and/or significant others. Representative measure(s): availability of strong support person (Tracey & Sedlacek, 1984). Representative item(s): "If I run into problems concerning school, I have someone who would listen to me and help me"
Stress (in general)	Definition: overwhelming negative emotionality resulting from general life stressors. Representative measure(s): perceived stress scale (Cohen et al., 1983). Representative item(s): "In the past month, how often have you felt that difficulties were piling up so high that you could not overcome them?"
Academic stress	Definition: overwhelming negative emotionality resulting from academic stressors. Representative measure(s): intensity scale (Maslach & Jackson, 1981), perceived stress (Cabrera, 1988). Representative item(s): see Jaramillo & Spector (2004)
Depression	Definition: low mood, pessimism, and apathy experienced over an extended length of time. Representative measure(s): Beck Depression Inventory (Beck et al., 1961). Representative item(s): see Beck et al. (1961)

[a] The self-control, independence, anxiety, extraversion, and tough mindedness traits from the 16PF were coded as conscientious, agreeableness, neuroticism, extraversion, and openness, respectively. [b] Consistent with Payne et al. (2007), when a two-dimensional measure of goal orientation was reported (e.g., Button et al., 1996) the correlations involving performance goal orientation were coded as performance approach goal orientation.

low in conscientiousness, they are less likely to persist with challenging work.

Students high in *openness* are expected to be more imaginative and willing to consider new ideas. These students may be better able to manage new learning essential to academic achievement (e.g., Vermetten, Lodewijks, & Vermunt, 2001; Zeidner & Matthews, 2000). Students high in openness and in *agreeableness* may be more likely to attend classes consistently (Lounsbury, Sundstrom, Loveland, & Gibson, 2003), and those high in agreeableness may also show greater levels of cooperation with instructors, which could facilitate the process of learning (Vermetten et al., 2001). By contrast, *neuroticism* is associated with higher anxiety (e.g., Watson & Clark, 1984) and test anxiety (Steel, Brothen, & Wambach, 2001), which can compromise performance on tests and examinations (Pekrun et al., 2004; Zeidner & Matthews, 2000), as well as reduce motivation (Watson, 2000). Chamorro-Premuzic and Furnham (2002) found that students high in neuroticism were more likely to be absent from examinations due to illness and noted that it is possible that poorer attendance, more generally, may also undermine academic performance among students high in neuroticism.

Extraversion implies greater sociability and activity levels. Students with extravert tendencies might be expected to achieve lower grades because they are more distracted and more sociable than students with introvert tendencies, who are likely to spend more of their time learning and consolidating knowledge (Rolfhus & Ackerman, 1999). Thus, extraversion may limit students' capacity to regulate their effort devoted to academic tasks (Bidjerano & Dai, 2007). Moreover, extraverts have been found to reach cognitive decisions prematurely (Matthews, 1997), which may curtail sys-

tematic consideration and checking required by many academic tasks.

Traits not easily encompassed by the five-factor model have been found to predict academic performance, in particular, *need for cognition* (Cacioppo, Petty, & Kao, 1984) and *emotional intelligence* (Mayer, Salovey, & Caruso, 2002). Higher need for cognition reflects greater intrinsic motivation to engage in effortful cognitive processing, with higher scores linked to better academic outcomes. The nomological network (Cronbach & Meehl, 1955) of need for cognition has not been specified, but this construct, which originated in research into processes underpinning message acceptance and persuasion, has many potential links. It is positively associated with fluid intelligence, openness, low neuroticism, and goal orientation (Fleischhauer et al., 2010) and may also be related to self-regulatory learning strategies including use of metacognition, elaboration, and deep learning. *Emotional intelligence* has been assessed in terms of abilities to perceive emotions accurately, understand emotion, and use emotion to facilitate thinking (Mayer et al., 2002). Emotional intelligence has also been assessed in terms of happiness, stress tolerance, and self-regard (Bar-On, 1997; Schutte et al., 1998). Both measures have been assessed alongside GPA; consequently, we treat emotional intelligence as a constellation of emotional capacities and tendencies implying greater capacity to maintain positive emotion and interpret emotions in a manner that may facilitate learning and academic performance.

In all, we have identified eight distinct personality measures that may be associated with GPA. These are conscientiousness, openness, agreeableness, neuroticism, extraversion (the Big Five factors), along with need for cognition, emotional intelligence, and procrastination (which is closely related to conscientiousness).

Motivation Factors

Personality may affect achievement through motivation and, of course, motivation may be measured directly (Phillips, Abraham, & Bond, 2003). There are many different theories of motivation (for a review, see Eccles & Wigfield, 2002), but only a limited number of motivational constructs has been repeatedly examined in relation to GPA. We consider these in three groups: (a) attributions, optimism, pessimism, expectancies, and perceived control; (b) sources of motivation; and (c) goal types.

Attributions, optimism, pessimism, expectancies, and perceived control. Attributions refer to the way people explain causation (Heider, 1958; Weiner, 1986) and particularly, in this context, students' explanations of past academic failures. Some students tend to explain poor grades in terms of their own (internal) failings, such as lack of effort and ability. Others tend to identify external causes, such as bad luck or insufficient teaching. Consequently, we can assess students' tendencies to make internal versus external attributions. Such tendencies are referred to as *locus of control* (Rotter, 1966). In addition, attributions may differ in their stability and globality. A *pessimistic attribution style* (Peterson, Vaillant, & Seligman, 1988) is characterized by internal, stable (unchanging), and global (cross-situational) attributions for past failures (e.g., "I am stupid"). In contrast, *optimistic* students are likely to make external, unstable, and specific attributions for past failures (e.g., "The examiner did not understand my work"), and internal, stable, global attributions for past successes (e.g., "I am capable and smart").

Outcome expectancies refer to perceptions of the association between behavior and outcome (e.g., "My studying hard will lead to good grades"). Optimistic attributions are associated with more positive outcome expectancies and stronger motivation (Abramson, Metalsky, & Alloy, 1989). Outcome expectancies can be distinguished from efficacy expectancies that refer to beliefs about personal capabilities (Bandura, 1997). This distinction is important because some students may believe that effort leads to good grades but see themselves as lacking the skills necessary to mobilize such effort. Others may believe in their capacity for effortful study but be uncertain whether such effort will lead to enhanced achievement.

Students who believe that they have the skills and abilities to succeed at academic tasks perform better than those with lower efficacy expectancies (Bandura, 1997). Efficacy expectations for any particular performance depend on students' experience with similar challenges. When challenges are familiar, students can draw upon past experiences to formulate expectations about specific performances. This has been referred to as *performance self-efficacy*. However, when challenges are unfamiliar, performance must be anticipated on the basis of more generalized representations of relevant competencies. This is referred to as *academic self-efficacy* (Zimmerman, Bandura, & Martinez-Pons, 1992).

Efficacy expectations refer to perceptions of personal capacities to perform. In contrast, *self-esteem* refers to the person's self-worth. One may have low performance self-efficacy and still have high overall self-worth. Consequently, self-esteem can be regarded as a trait-like construct. However, following Eccles and Wigfield, (2002), we have categorized academic self-esteem as a motivational construct because of its close links to academic attributions and the evaluation of academic success among students. According to self-worth theory (Covington, 1998), academic ability is a core, universal component of self-worth that individuals are motivated to maintain. For example, attributing failure to a lack of effort protects academic self-esteem but may also lead to a reduction in effort owing to fear of failure. Moreover, as a result of such attributional tendencies, students may differ in how much they value academic achievement (Harter, 1998), and constructing a more positive academic self-concept is associated with enhanced achievement (Hattie, 1993).

Sources of motivation. Rather than characterizing how motivated people are, self-determination theory (Ryan & Deci, 2000) distinguishes between sources of motivation, or reasons for task engagement. The theory proposes that task engagement results in satisfaction of basic psychological needs, namely, autonomy, competence, and relatedness. Activities undertaken for pleasure inherent to the task (*intrinsic motivation*) are associated with optimal self-regulation involving autonomy and efficiency, whereas tasks engaged in for instrumental reasons, such as the offer of a reward or avoidance of a punishment (*extrinsic motivation*), are linked to controlled motivation and volitional difficulties (deCharms, 1968). Self-determination theory proposes that intrinsic motivation is achieved and maintained through stimulating and challenging task engagement in which the actor feels competent and autonomous. Such intrinsic motivation facilitates optimal learning, whereas extrinsic motivation may stifle motivation and performance.

Goal types. The type of goal students pursue during academic study can affect their source and degree of motivation and, subsequently, their performance. It has been suggested, for example, that students' motivation may be improved by focusing on effort and self-improvement (which are intrinsically motivated goals) rather than on achievement and competition (which are extrinsically motivated goals; Covington, 1992). It is possible, therefore, to distinguish between students who are primarily oriented toward learning goals and those who are most focused on performance goals. Performance goals may be inherently extrinsically motivated but can have differing effects on performance depending on whether they are performance approach goals, focused on anticipation of positive achievement, or performance avoidance goals, directed toward escaping from anticipated failure or negative evaluation (Elliot & Harackiewicz, 1996). Performance avoidance goals have been found to be associated with reduced motivation and achievement (Elliot & Church, 1997), whereas performance approach goals may enhance academic motivation and evaluation of academic competence (Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002). We distinguish between *learning goal orientation*, *performance goal orientation* (referring to performance approach goals), and *performance avoidance goal orientation.*

Goal theories (e.g., Locke & Latham, 1990) suggest that performance feedback is central to goal setting and goal striving. In an academic context, performance feedback usually consists of grades awarded for exams and assignments (Wood & Locke, 1987). Performance self-efficacy and grade expectancies are expected to stabilize as performance feedback is accumulated (Bandura, 1997; Lent & Brown, 2006) and, consequently, to be most strongly predictive of GPA among experienced students (Pajares & Miller, 1995). In this context we can define a *grade goal* (e.g., "I want to get 65% on this test") as a specific performance goal based on prior feedback.

Overall, we have identified 12 distinct but closely related motivational constructs that may be correlated with GPA: locus of control, pessimistic attributional style, optimism, performance self-efficacy, academic self-efficacy, self-esteem, academic intrinsic motivation, academic extrinsic motivation, learning goal orientation, performance goal orientation, performance avoidance goal orientation, and grade goal.

Self-Regulatory Learning Strategies

Students regulate their cognitions, emotions, motivation behaviors, and environment (Boekaerts & Corno, 2005). The motivational factors we have considered do not encompass differences between students in their typical use of self-regulatory learning strategies. Yet the extent to which students employ such strategies may mediate (and moderate) the effects of dispositional characteristics (e.g., intellectual capacity and personality) and psychosocial contextual influences on academic performance.

Theorists have distinguished between motivation and volition, with motivation culminating in the formation of goals or behavioral intentions and volition guiding the translation of goals into actions (Kuhl, 2000). According to Gollwitzer's (1990) "rubicon" model, decisions about why one should act and where one should invest effort are part of the goal-setting process that precedes goal commitment. Once a goal has been formulated, goal striving begins. In this phase, regulatory processes focus on how to best implement effort (Boekaerts & Corno, 2005). Students' use of distinct self-regulatory strategies may render such post-motivational goal striving more or less effective, thereby predicting performance. Thus, assessment of self-regulatory strategies may facilitate greater accuracy in predicting academic performance (for reviews, see Pintrich, 2004; Wolters et al., 2003).

Pintrich's (2004) model of self-regulated learning comprises the most comprehensive set of constructs assessing learning-related, self-regulatory strategies. Four areas of self-regulated learning are assessed: motivation/affect, cognition, behavior, and context. This model has been assessed with the Motivated Strategies for Learning Questionnaire (MSLQ). This multimeasure assessment tool includes constructs discussed above but uses different labels to describe some of these constructs. In particular, the MSLQ constructs of intrinsic goals, extrinsic goals, task value, and self-efficacy map onto what we refer to as (a) learning goal orientation, (b) performance approach goal, (c) academic intrinsic motivation, and (d) academic self-efficacy, respectively.

The MSLQ also assesses *test anxiety*. This construct can be viewed as a trait related to neuroticism but can also be conceptualized as indicative of a specific form of affect control. Adopting the latter view, we grouped this construct with other self-regulatory capacities. In addition, the MSLQ measures control of learning beliefs, but this construct has only rarely been included in studies assessing GPA and was, therefore, omitted from our analyses.

Cognitive strategies assessed by the MSLQ include rehearsal, elaboration, organization, and critical thinking, as well as more general measures of metacognitive self-regulation (Pintrich, 2004). *Rehearsal* strategies include "shallow" learning techniques such as rote learning, which is learning through repetition, whereas *organization* (e.g., note taking and organizing points meaningfully), *elaboration* (e.g., summarizing material using one's own words), and *critical thinking* (e.g., questioning the validity of key texts and materials) reflect increasingly "deeper" learning strategies that are proposed to facilitate learning and achievement. *Metacognition* refers to a cluster of self-regulatory techniques utilized during learning (Wolters et al., 2003). These include planning (e.g., setting learning goals), self-monitoring (e.g., of comprehension), and flexibility (e.g., selection and implementation of task-appropriate learning strategies).

Assessment of behavioral self-regulatory capacities (Pintrich, 2004) includes a measure of *effort regulation* that encompasses self-management of motivation or persistence when challenged by difficult work. Effort regulation is related to conscientiousness and academic self-efficacy. Achievement motivation and effort regulation are closely related constructs and illustrate how different labels may be used for similar predictors of scholastic performance in different research domains, in this case, studies of personality traits versus self-regulatory capacities. Pintrich (2000) also identified *help seeking* as a behavioral strategy encompassing "other regulation" (i.e., the actions of teachers and peers; Ryan & Pintrich, 1997; Wolters et al., 2003). Finally, the MSLQ includes measures of the regulation of the learning contexts (Pintrich, 2004) including a measure of *peer learning,* which involves talking to peers about their learning, whereas *time/study management* assesses use of study plans and the regulation of the learning environment (e.g., turning off the television while studying). Use of the MSLQ illustrates multimeasure research into the importance of

volitional control of action to students' performance (Corno, 1989, 1993; Kuhl, 2000; Wolters et al., 2003), but it is unclear whether this inventory is comprehensive or optimal in its selection of predictors.

Like the MSLQ, the Learning and Study Strategy Inventory (LASSI; Weinstein, Palmer, & Schulte, 1987) is a multimeasure (10-scale) assessment inventory designed to identify tertiary-level students' strengths and weaknesses. The two inventories overlap substantially but use different nomenclature. For example, measures of information processing, selecting main ideas, self-testing, motivation, and time management in the LASSI map directly onto the MSLQ measures of elaboration, organization, metacognition, effort regulation, and time/study management, respectively. The LASSI also assesses *concentration,* which refers to students' ability to direct and maintain attention during study. Additionally, the LASSI includes measures of test strategies, study aids, and "attitude," but these have rarely been investigated as correlates of tertiary GPA and so are not included in our analyses. To clarify the labeling of these self- regulatory measures we have provided a table (see Table 3) listing measures and labels used in the MSLQ, the LASSI, and this study.

Overall, we have identified 11 distinct but related self-regulatory learning capacities that may be correlated with GPA: test anxiety, rehearsal, organization, elaboration, critical thinking, metacognition, effort regulation, help seeking, peer learning, time/study management, and concentration.

SAL Models

SAL models provide broader characterizations of learning tendencies than do assessments of self-regulatory strategies (Pintrich, 2004). Three broad approaches to learning have been identified (Biggs, 1987; Craik & Lockhart, 1972; Entwistle, Hanley, & Hounsell, 1979). The *deep* approach is characterized by learning strategies such as critical evaluation and information syntheses combined with an intrinsic motivation to learn. By contrast, *surface* approaches involve shallow cognitive strategies, such as memorization and rehearsal, in combination with an extrinsic motivation to learn. Finally, students adopting a *strategic* approach are thought to use both deep and surface strategies depending on the importance and characteristics of the task. Deep strategies are assumed to promote optimal learning and enhanced performance, although the relationship between SAL and achievement may be moderated by assessment method (Boyle, Duffy, & Dunleavy, 2003), task (Dart & Clarke, 1991) and teaching style (Ramsden, 1979; Richardson, 1995; Wilson, Smart, & Watson, 1996) highlighting the importance of context and students' perceptions of context. SAL models encompass motivational and self-regulatory constructs. Thus the question arises as to whether these three approaches to learning (deep, surface, and strategic) are redundant or are useful additional characterizations of students' capacities and tendencies that facilitate prediction of GPA.

Psychosocial Contextual Influences

Prior to the work of Tinto (1975) and Bean (1980), research on student attrition and work persistence had focused on student characteristics. Tinto's educational persistence model focused on "the impact that the institution itself has, in both its formal and informal manifestations, on the withdrawal behaviors of its own students" (Tinto, 1982, p. 688). According to this model, university systems interact with student characteristics (e.g., sex, ethnicity, values) and experiences (e.g., past achievement) to determine students' degree of interaction with social (e.g., peers), and academic systems (e.g., academic advisers and wider university systems). Optimal adjustment results in stronger *social, academic,* and *institutional integration* as well as greater *goal commitment* (e.g., commitment to obtaining a degree), which supports students' persistence, and academic achievement. Students whose academic experiences create conflicts with previously established beliefs and values may find integration challenging (Tinto, 1993) and therefore perform less well. Similar research by Bean (1980) and

Table 3
Motivated Strategies for Learning Questionnaire (MSLQ), Learning and Study Strategies Inventory (LASSI), and the Study Measures

Study measures	MSLQ (15 scales, 81 items)	LASSI (10 scales, 77 items)
Rehearsal	Rehearsal	n.a.
Elaboration	Elaboration	Information processing
Organization	Organization	Selecting main ideas
Critical thinking	Critical thinking	n.a.
Metacognition	Metacognitive self-regulation	Self-testing
Effort regulation	Effort regulation	Motivation
Time/study management	Time/study management	Time management
Peer learning	Peer learning	n.a.
Help seeking	Help seeking	n.a.
Academic intrinsic motivation	Task value	n.a.
Learning goal orientation	Intrinsic goal orientation	n.a.
Performance approach orientation	Extrinsic goal orientation	n.a.
Academic self-efficacy	Self-efficacy for learning & performance	n.a.
Test anxiety	Test anxiety	Anxiety
Concentration	n.a.	Concentration
n.a.	Control of learning beliefs	n.a.
n.a.		Attitude
n.a.		Study aids
n.a.		Test strategies

Note. n.a. = not available.

colleagues (Bean & Metzner, 1985; Elkins, Braxton, & James, 2000; Metzner & Bean, 1987; Stoecker, Pascarella, & Wolfle, 1988) highlighted external influences on integration, such as family support, finances, and hours of paid employment. These contextual influences are thought to shape students' responses to university life, including affective responses such as *stress* and *depression*, in addition to goal commitment and value assessments that in turn, affect integration and academic performance.

We have identified eight psychosocial contextual influences. These include three aspects of organizational integration: social, academic, and institutional integration plus five other factors: goal commitment, social support, general stress, academic stress, and depression.

Demographic Correlates of GPA: Age, Sex, and Socioeconomic Status

Population demographics and political positions on higher education have changed over time in the United States and Europe, resulting in more diverse student populations. It is important, therefore, to explore the role of demographic influences on academic achievement. Recent trends show that, on average, students from higher socioeconomic backgrounds and women attain higher GPAs than do their respective counterparts (e.g., Dennis, Phinney, & Chuateco, 2005; LaForge & Cantrell, 2003; Robbins et al., 2004; Smith & Naylor 2001). Higher socioeconomic status may facilitate effective academic and social adaption to university settings; however, questions remain about the gender gap in performance with course selection, assessment methods, and psychological characteristics identified as possible influences. Older students are also expected to adapt better to university situations (Clifton, Perry, Roberts, & Peter, 2008) but mixed findings are reported. Some studies have shown that older students achieve higher GPAs (Clifton et al., 2008; Etcheverry, Clifton, & Roberts, 2001), whereas others have failed to observe this association (Farsides & Woodfield, 2007; Ting & Robinson, 1998). Consequently, we included age, sex, and socioeconomic status in our analyses.

Which Correlates of GPA Are Most Important?

Previous reviews have considered predictors of undergraduate GPA drawing upon subsets of the literature we have considered. The most comprehensive study, by Robbins et al. (2004), reviewed a range of motivational, skill, and contextual factors. They found that achievement motivation, here referred to as effort regulation (Pintrich, 2004), and academic self-efficacy were the best predictors of GPA and that women students and those from higher socioeconomic status backgrounds attained high GPA scores.

In a meta-analysis of relationships between five-factor personality traits and GPA, O'Connor and Paunonen (2007) reported a small to medium effect size for conscientiousness and very small effects for extraversion, neuroticism, openness, and agreeableness. This pattern was largely confirmed in a comprehensive Five-Factor meta-analysis by Poropat (2009), who also found support for a predictive role for conscientiousness over and above that of intelligence. Similarly, a review by Steel (2007) found that procrastination was moderately and negatively associated with GPA. Measures of need for cognition and emotional intelligence have also been shown to have small effects on GPA (Cacioppo & Petty, 1982; Parker, Duffy, Wood, Bond, & Hogan, 2005).

Evidence for other academic goals and GPA is less clear. A review by Payne, Youngcourt, and Beaubien (2007) found a very small negative relation between performance avoidance goals and GPA and little evidence of a relation between performance approach goals and GPA. Yet, in a similar review, Linnenbrink-Garcia, Tyson, and Patall (2008) found evidence of small positive relationships between GPA and both performance approach goals and learning goals. Still, Pekrun, Elliot, and Maier (2009) concluded that the effect of learning goals is weak and may disappear with control of the effects of other academic goals.

The Present Study

Our review identified five traditional correlates of tertiary GPA (intelligence, SAT, ACT, high school GPA, and A level points) and three demographic factors (sex, age, and socioeconomic status). In addition, we identified 42 non-intellective constructs that have been identified as potentially useful correlates of tertiary GPA. We grouped these into five conceptually overlapping research areas: personality traits (8 constructs), motivational factors (12 constructs), self-regulatory learning strategies (11 constructs), students' approaches to learning (3 constructs), and psychosocial contextual influences (8 constructs; see Table 1). As the direction of an effect cannot be reliably inferred from cross-sectional measurement, study design was explored as a moderator (i.e., prospective design measuring the predictor prior to the assessment of GPA vs. cross-sectional association at the same point in time).

This diverse literature raises a series of questions answerable by quantitative analysis: (a) how strong are the univariate associations between these diverse constructs and GPA? (b) are observed correlations moderated by cross-sectional versus prospective study designs? (c) which constructs are most important within the five research domains we have identified? (d) do non-intellective constructs explain additional variance in GPA controlling for traditional correlates (as defined above)? and (e) can we construct a comprehensive but parsimonious model of factors that most strongly influence university students' academic attainment?

Method

Searches and Inclusion Criteria

We undertook a systematic search in stages to locate primary articles. Search terms contained adjectives or derivatives of *determinants, academic achievement,* and *undergraduate student* that were combined with a series of Boolean and/or operators and asterisk wildcards (see Table 4). These combinations were used to search PsycINFO and the Web of Knowledge databases between 1997 and 2010. Only English language journals were considered; studies conducted outside Europe or North America were excluded because so few studies were located. This search yielded in total 7,167 records that were exported into a reference citation manager where titles and abstracts were screened for relevance.

At Stage 2, studies were included if they reported an association between a measure of GPA and a measure of at least one non-intellective construct listed in Table 2. At Stage 3, ancestry (searching the references of included articles) and descendancy (searching articles citing included articles using Web of Knowledge) searches were conducted to locate further primary articles of

Table 4
Search Terms Used in the Meta-Analysis

The following search terms were used:
"undergraduate student"
(Freshman or undergraduate* or sophomore*) or (junior student*) or (senior student*) or (upper division student*) or (university student*)
"academic achievement"
(GPA or GPAs or grade or grades or mark or marks) or (academic outcome*) or (grade point average*) or (academic achievement*) or (academic performance*) or (associate* degree*) or (college perform*) or (college achievement*)
"determinants"
(determin* or factor or factors or variabl* or parameter* or reason* or caus* or correlat* or antecedent* or predictor or predictors)

potential relevance. These were then screened using the Stage 2 inclusion criterion. This process continued cyclically until no new articles emerged. More than 400 papers were read. However, relevant data were not obtainable for many. After duplicate data sets were excluded, this process generated 217 papers that contained 241 unique data sets (55 in Europe and 186 in North America).

The effect size *r* was used to represent the direction and strength of associations between GPA and its correlates because it is the most common effect size measure used in studies of academic performance. GPA measures included students' overall degree marks, quarter, semester, course, or test marks. We also recorded demographic constructs (age, sex, and socioeconomic status) and intellective constructs (SAT, ACT, A level points, high school GPA, and general intelligence) when these were reported. Where data were missing, study authors were contacted; if they did not respond, we used available statistics, such as *t*, *F,* or χ^2 values, to derive *r* wherever possible (for formulas, see, e.g., Hunter & Schmidt, 1990). Papers from which data were extracted are marked with an asterisk in the reference section.

Measures and Data Extraction

Measures of cumulative GPA over semesters or years (GPA_{cum}) provide the most reliable proxy of undergraduate achievement, whereas measures of GPA over a shorter time span (e.g., a single course or test situation; GPA_{course}) contain less information. To obtain a reliability coefficient for GPA_{course}, we meta-analysed *r*s between GPA_{cum} and GPA_{course}. Results showed a true score correlation of .59 ($k = 9$, $N = 1{,}581$) for GPA_{cum}/GPA_{course} combinations. Consequently, we assigned a reliability coefficient of 1 to measures of GPA_{cum} and a coefficient of .6 to measures of GPA_{course}.

Table 2 shows representative measures and items used to assess the 42 non-intellective constructs considered in this study. Where standardized measures were not used, data were coded only if illustrated items or clear definitions that corresponded to the definitions listed in Table 2 were provided. In combination with the demographic (age, sex, and socioeconomic status) and traditional constructs (SAT, ACT, high school GPA, and intelligence), we considered 50 constructs. Measures of socioeconomic status typically assessed income and educational levels (e.g., Robbins, Allen, Casillas, Peterson, & Le, 2006), whereas intelligence was measured with validated assessment instruments such as the revised Wechsler Adult Intelligence Scale (Wechsler, 1981).

We coded the following data from each primary article where present:

1. Full reference details
2. Study location (Europe/North America)
3. GPA type (GPA_{cum}/GPA_{course})
4. Constructs
5. Internal reliability of constructs
6. Correlation type
7. Correlation effect size and direction
8. Effect size *N*
9. Study design (prospective/cross-sectional/mixed/not known)

Correlations were reverse scored where necessary, so that higher scores represented higher levels of the defined construct. We extracted prospective data when possible and identify them with the abbreviation *pro*; we identify concurrent data as *cs* (cross-sectional). For some correlations the data were a mixture of cross-sectional and prospective data (e.g., where cumulative GPA was a combination of future and past behavior**),** identified as *mixed.* In other studies it was not possible to determine the design from the report. In these cases the data are identified as *notk* (not known). We collated information on study design for non-intellective factors only, given that traditional correlates and demographic information were generally retrospective rather than self-reported in real time. Measures of intelligence constitute an exception, but it is well known that test scores are fairly stable over time (Jones & Bayley, 1941).

Following Hunter and Schmidt's (2004) recommendations, no more than two conceptually equivalent construct/GPA combinations from any one study entered the analysis. When three or more measures of GPA criterion and/or conceptually equivalent constructs were reported, we combined data to create a composite. Where multiple measures of GPA were not independent, only the most reliable measure of GPA (i.e., GPA_{cum}) was extracted. In such instances, composite correlations were calculated where possible, using Hunter and Schmidt's (2004) formula; otherwise, correlations were averaged. The sample *N* was reported in all cases (Hunter & Schmidt, 2004). When psychological composites were calculated we used the Spearman–Brown formula (see Hunter & Schmidt, 2004) to calculate corresponding internal reliabilities; we also averaged the reliabilities of averaged correlations. All remaining correlations were either bivariate *r*s as reported in the original source or data that were transformed into a correlation coefficient from information contained in the report. We recorded corresponding alpha reliability coefficients wherever possible. When reliability estimates were not provided, such information was obtained from the inventories' manuals and/or previous articles that had

reported the reliability of corresponding scales. The reliability of traditional intellective variables (SAT, ACT, A level points, high school GPA, and intelligence) was assumed to be 1 unless information contained in the report stated otherwise.

Interrater Reliability

Prior to analysis, 54 (22%) distinct data sets were selected at random and coded by two independent, doctoral psychology students according to the construct definitions provided in Table 2. Constructs were identified as being present or absent for each data set, resulting in 54 kappa scores. Perfect agreement is indicated by a score of 1.0. Observed scores ranged from .62–1.0, with 47/54 (87%) recorded as 1.0.

Analytic Strategy

We tested hypotheses in three analytic steps. First, meta-analyses were conducted to generate average weighted correlations (r^+) between GPA and each other separate construct. Second, we conducted moderator analyses using study design (prospective vs. cross-sectional) where sufficient data were available. Third, we conducted a series of regression analyses to test which particular constructs (for which data were available) were the best predictors of GPA. GPA was regressed onto all relevant constructs within each of the five non-intellective domains. We also conducted regression analyses to explore which of the best predictors of GPA (for which data were available) explained variation over and above the traditional assessment methods already used in practice. Colleges in North America typically use either the SAT or the ACT, so these were treated as a single construct in the regression models alongside high school GPA. A further regression model examined a cross-domain integrative model of academic performance that included the most significant measures of GPA.

Meta-Analyses

Meta-analyses were conducted with a random effects model, because accumulated evidence suggested heterogeneity in effect sizes (National Research Council, 1992) and we wished to draw inferences beyond the particular set of studies included in the analysis (Borenstein, Hedges, Higgins, & Rothstein, 2010; Hedges & Vevea, 1998). Following Hedges and Olkin (1985), we conducted analyses on correlations transformed into Fisher's *z;* we then back-transformed results, such as means and the limits of confidence intervals, so that they could be expressed in terms of *r*. I^2 and Q statistics were calculated to assess the residual variance. Cochran's (1954) Q statistic reflects the total amount of variance in the meta-analysis, whereas Higgins and Thompson's (2002) I^2 value indexes the proportion of variance due to between-study differences. Unlike the Q statistic, it is not sensitive to the number of associations considered. A statistically significant Q statistic indicates substantial heterogeneity, whereas I^2 values range from 0 to 100%. It has been suggested that values of 25%, 50%, and 75% indicate low, moderate, and high heterogeneity, respectively (Higgins, Thompson, Deeks, & Altman, 2003). In addition, rho correlations were calculated in which observed correlations were corrected for reliability in both the GPA criterion and the predictor variable, with data analyzed with the Hunter and Schmidt (2004) approach. We also calculated credibility intervals of 80% around the mean rho correlations (Hunter & Schmidt, 2004) to assess the validity of generalizing from calculated mean effects.

Our analyses were inspected after the removal of outliers and influential cases to identify when our conclusions would be substantially altered by their omission. Following Viechtbauer and Cheung (2010), we drew on three indices: studentized deleted residuals; DFFITS, and Cook's distance. Viechtbauer and Cheung provided some rules of thumb for instances in which the effect of possible outliers or influential cases may require further scrutiny. For the studentized deleted residuals, they suggested that finding more than $k/10$ residuals greater than ± 1.96 would be unusual. For the DFFITS_i measure, Viechtbauer (2011) suggested that, for a random effects model, a value greater than $3\sqrt{1/(k-1)}$, where k is the number of effects, requires closer inspection. For the Cook's distance measure, he suggested inspecting cases where the resulting value exceeds the value of χ^2, $df = 1$, that cuts off 0.5 in the lower tail area. We have used all three criteria in evaluating the effect of outlying studies on our results.

Publication of statistically significant results is more probable (e.g., Greenwald, 1975), increasing the likelihood of Type I errors and an overestimation of the mean effect size in meta-analysis. To examine this potential bias, we applied Duval and Tweedie's (2000) "trim-and-fill" procedure, which first estimates the number of studies that may be missing due to publication bias. Missing studies are subsequently imputed and the effect size recalculated. For all analyses, we used the package Metafor in R (Viechtbauer, 2010), Field and Gillett's (2010) macros, and Cheung's (2009) LISREL syntax generator.

Results

Data Description

In total, 1,105 independent correlations were analyzed (911 relating to non-intellective constructs, 59 to demographics, and 135 to traditional constructs; i.e., SAT, ACT, high school GPA, A level points, and intelligence). Of these, 768 and 337 were correlations with measures of GPA_{cum} and $\text{GPA}_{\text{course}}$, respectively. Of the non-intellective associations, 400 were prospective, 228 were cross-sectional, and 108 were of mixed design. We could not determine the design of 175 additional correlations. Table 5 details the design and GPA criterion information for each construct separately.

Meta-analyses of the following constructs were based on five or fewer independent correlations: U.K. A level points, need for cognition, performance self-efficacy, peer learning, and academic-related stress (*N*s ranged from 933 to 1,418; *k*s from 4 to 5). Other correlations were based on good sample sizes (*N*s ranged from 1,026 to 75,000) drawn from larger numbers of samples (*k*s ranged from 6 to 69).

Table 6 presents the meta-analytic results for each correlate and includes details of sample size (N) and the number of independent correlation coefficients (k) upon which each mean or weighted correlation is based. For each construct, we report the mean, weighted correlation (r^+) and corresponding 95% confidence intervals (CIs), I^2, and Q statistics. The rho (ρ) correlations are reported together with 80% credibility intervals

Table 5
Summary of Non-Intellective/GPA Combinations by Study Design and GPA Criterion

Measure	Prospective design *N* (*k*)	Cross-sectional design *N* (*k*)	Mixture of prospective and cross-sectional designs *N* (*k*)	Design not reported *N* (*k*)	Total *N* (*k*)	Combinations with cumulative GPA	Combinations with course GPA
Personality traits							
Conscientiousness	8,090 (30)	15,160 (15)	2,744 (10)	1,881 (14)	27,875 (69)	52	17
Procrastination	401 (3)	1,335 (6)	0	130 (1)	1,866 (10)	6	4
Openness	4,947 (18)	14,507 (13)	1,246 (17)	2,396 (14)	23,096 (52)	41	11
Neuroticism	4,818 (20)	14,582 (14)	1,246 (7)	3,013 (17)	23,659 (58)	45	13
Agreeableness	3,916 (15)	14,251 (12)	1,121 (6)	2,446 (14)	21,734 (47)	39	8
Extraversion	5,102 (21)	14,600 (14)	1,246 (7)	2,782 (16)	23,730 (58)	46	12
Need for cognition	296 (2)	138 (1)	0	984 (2)	1,418 (5)	2	3
Emotional intelligence	2,525 (4)	378 (1)	137 (1)	1,984 (8)	5,024 (14)	14	0
Total (personality traits)	30,095 (113)	74,951 (76)	7,740 (38)	15,616 (86)	128,402 (313)	245	68
Motivation factors							
Locus of control	648 (3)	1,019 (6)	0	459 (4)	2,126 (13)	8	5
Pessimistic attributional style	403 (3)	379 (3)	0	244 (2)	1,026 (8)	4	4
Optimism	689 (3)	153 (1)	0	522 (2)	1,364 (6)	4	2
Academic self-efficacy	35,171 (29)	6,151 (20)	3,883 (12)	1,365 (6)	46,570 (67)	47	20
Performance self-efficacy	0	345 (3)	0	1,002 (1)	1,348 (4)	4	0
Self-esteem	1,117 (5)	2,889 (13)	408 (1)	381 (2)	4,795 (21)	18	3
Academic intrinsic motivation	3,500 (6)	1,826 (6)	1,009 (6)	1,079 (4)	7,414 (22)	17	5
Academic extrinsic motivation	1,080 (3)	285 (2)	341 (3)	633 (2)	2,339 (10)	10	0
Learning goal orientation	10,033 (37)	3,086 (12)	553 (1)	4,643 (10)	18,315 (60)	22	38
Performance goal orientation	10,261 (36)	2,772 (12)	690 (2)	4,643 (10)	18,366 (60)	25	35
Performance avoidance goal orientation	6,663 (22)	1,606 (6)	553 (1)	1,891 (2)	10,713 (31)	14	17
Grade goal	2,670 (13)	0	0	0	2,670 (13)	0	13
Total (motivation factors)	72,235 (160)	20,511 (84)	7,437 (26)	16,862 (45)	115,698 (315)	173	142
Self-regulatory learning strategies							
Test anxiety	7,122 (16)	5,367 (8)	486 (3)	522 (2)	13,497 (29)	12	17
Rehearsal	1,728 (5)	608 (2)	631 (2)	237 (2)	3,204 (11)	6	5
Organization	5,076 (4)	219 (1)	0	115 (9)	5,410 (6)	4	2
Elaboration	6,374 (6)	608 (2)	787 (2)	237 (2)	8,006 (12)	7	5
Critical thinking	1,532 (3)	219 (1)	1,958 (4)	115 (1)	3,824 (9)	5	4
Metacognition	5,445 (5)	411 (2)	234 (1)	115 (1)	6,205 (9)	5	4
Effort regulation	5,914 (7)	1,924 (7)	264 (1)	760 (4)	8,862 (19)	15	4
Help seeking	954 (4)	419 (2)	684 (2)	0	2,057 (8)	7	1
Peer learning	0	219 (1)	918 (3)	0	1,137 (4)	3	1
Time/study management	4,982 (3)	634 (3)	0	231 (1)	5,847 (7)	7	0
Concentration	6,476 (10)	200 (1)	122	0 (1)	6,798 (12)	9	3
Total (self-regulatory learning strategies)	45,603 (63)	10,828 (30)	6,084 (18)	2,332 (15)	64,847 (126)	80	46
Students' approach to learning							
Deep learning style	1,993 (9)	689 (3)	1,105 (5)	1,424 (6)	5,211 (23)	7	16
Surface learning style	1,993 (9)	1,039 (2)	505 (3)	1,301 (8)	4,838 (22)	10	12
Strategic learning style	1,320 (5)	305 (2)	146 (1)	1,003 (7)	2,774 (15)	4	11
Total (students' approach to learning)	5,306 (23)	2,033 (7)	1,756 (9)	3,728 (21)	12,823 (60)	21	39
Psychosocial contextual influences							
Social integration	16,260 (7)	2,299 (7)	469 (1)	0	19,028 (15)	14	1
Academic integration	5,826 (4)	1,365 (3)	684 (2)	5,880 (2)	13,755 (11)	11	0
Institutional integration	18,582 (11)	540 (4)	182 (2)	469 (1)	19,773 (18)	17	1
Goal commitment	11,191 (6)	1,150 (2)	288 (1)	469 (1)	13,098 (10)	9	1
Social support	4,467 (7)	1,077 (5)	296 (2)	0	5,840 (14)	13	1
Stress (in general)	184 (1)	230 (1)	1,172 (5)	150 (1)	1,736 (8)	8	0
Academic stress	287 (2)	185 (1)	0	469 (1)	941 (4)	3	1
Depression	905 (3)	4,204 (8)	985 (4)	241 (2)	6,335 (17)	16	1
Total (psychosocial contextual influences)	57,702 (41)	11,050 (31)	4,076 (17)	7,678 (8)	80,506 (97)	91	6
Total (non-intellective correlates)	210,941 (400)	119,373 (228)	27,093 (108)	46,216 (175)	403,623 (911)	610	301

Table 6
Results of the Primary Meta-Analyses

Measure	*N*	*k*	r^+	$CI_{r+}95\%$	I^2	Q	ρ	*SD*	CV, 80% *L*	CV, 80% *H*	Trim and fill procedure k^a	Trim and fill procedure r^{+b}
Demographic correlates												
Socioeconomic status	75,000	21	0.11	[0.08, 0.15]	92.53%	221.26**	0.15	0.00	0.08	0.22	0	n.a.
Sex[c]	6,176	21	0.09	[0.04, 0.15]	80.43%	121.90***	0.04	0.01	0.11	−0.19	5	0.05
Age	42,989	17	0.08	[0.03, 0.13]	91.85%	353.49**	0.03	0.01	−0.08	0.14	2	0.09
Traditional correlates												
High school GPA	34,724	46	0.40	[0.35, 0.45]	96.19%	1368.25**	0.41	0.03	0.20	0.63	9	0.45
SAT	22,289	29	0.29	[0.25, 0.33]	85.15%	258.59**	0.33	0.01	0.21	0.45	1	0.30
ACT	31,971	21	0.40	[0.33, 0.46]	97.67%	314.49***	0.40	0.01	0.30	0.49	7	0.50
A level points	933	4	0.25	[0.12, 0.38]	73.63%	12.07**	0.31	0.01	0.19	0.43	0	n.a.
Intelligence	7,820	35	0.20	[0.16, 0.24]	71.78%	117.94**	0.21	0.01	0.08	0.34	5	0.22
Personality traits												
Conscientiousness	27,875	69	0.19	[0.17, 0.22]	65.25%	165.12**	0.23	0.00	0.16	0.30	3	0.19
Procrastination	1,866	10	−0.22	[−0.27, −0.18]	5.04%	13.77 *ns*	−0.25	0.00	−0.33	−0.17	0	n.a.
Openness	23,096	52	0.09	[0.06, 0.12]	61.76%	118.60**	0.09	0.00	0.01	0.17	8	0.07
Neuroticism	23,659	58	−0.01	[−0.04, 0.01]	68.81%	163.70**	0.01	0.01	−0.09	0.11	0	n.a.
Agreeableness	21,734	47	0.07	[0.04, 0.09]	60.16%	103.05**	0.06	0.00	−0.02	0.13	6	0.05
Extraversion	23,730	58	−0.04	[−0.07, −0.02]	66.09%	137.35**	−0.03	0.00	−0.12	0.05	2	−0.05
Need for cognition	1,418	5	0.19	[0.04, 0.33	86.43%	22.08**	0.17	0.01	0.03	0.31	0	n.a.
Emotional intelligence	5,024	14	0.14	[0.10, 0.18]	32.53%	21.37 *ns*	0.17	0.00	0.10	0.23	0	n.a.
Motivation factors												
Locus of control[d]	2,126	13	0.13	[0.04, 0.22]	77.81%	44.85**	0.15	0.02	−0.02	0.32	0	n.a.
Pessimistic attributional style	1,026	8	0.01	[−0.12, 0.13]	73.71%	26.89**	−0.01	0.03	−0.22	0.20	0	n.a.
Optimism	1,364	6	0.11	[0.04, 0.17]	32.51%	7.46 *ns*	0.13	0.00	0.06	0.20	2	0.14
Academic self-efficacy	46,570	67	0.31	[0.28, 0.34]	90.94%	497.07**	0.28	0.01	0.14	0.41	0	n.a
Performance self-efficacy	1,348	4	0.59	[0.49, 0.67]	70.91%	10.63*	0.67	0.00	0.61	0.74	2	0.64
Self-esteem	4,795	21	0.09	[0.05, 0.13]	47.06%	40.54**	0.12	0.01	0.04	0.20	4	0.11
Academic intrinsic motivation	7,414	22	0.17	[0.12, 0.23]	83.30%	137.81*	0.16	0.02	−0.03	0.35	2	0.15
Academic extrinsic motivation	2,339	10	0.01	[−0.06, 0.08]	59.05%	21.91*	0.00	0.01	−0.11	0.11	3	0.05
Learning goal orientation	18,315	60	0.10	[0.09, 0.14]	48.08%	114.25*	0.12	0.00	0.03	0.21	12	0.08
Performance goal orientation	18,366	60	0.09	[0.06, 0.12]	72.49%	184.97**	0.14	0.01	0.02	0.26	1	0.09
Performance avoidance goal orientation	10,713	31	−0.14	[−0.18, −0.09]	79.20%	113.73**	−0.14	0.01	−0.29	0.01	4	0.11
Grade goal	2,670	13	0.35	[0.28, 0.42]	74.39%	37.75**	0.49	0.01	0.36	0.62	2	0.38
Self-regulatory learning strategies												
Test anxiety	13,497	29	−0.24	[−0.29, −0.20]	79.33%	93.40**	−0.21	0.01	−0.31	−0.11	0	n.a
Rehearsal	3,204	11	0.01	[−0.07, 0.10]	81.43%	45.57**	0.05	0.02	−0.12	0.22	0	n.a
Organization	5,410	6	0.04	[−0.06, 0.15]	69.45%	18.38**	0.20	0.00	0.09	0.20	0	n.a
Elaboration	8,006	12	0.18	[0.11, 0.24]	83.54%	58.00**	0.14	0.01	0.03	0.25	0	n.a
Critical thinking	3,824	9	0.15	[0.11, 0.18]	0.00%	5.39 *ns*	0.16	0.00	0.16	0.16	0	n.a
Metacognition	6,205	9	0.18	[0.10, 0.26]	76.60%	30.18**	0.14	0.00	0.05	0.22	3	0.12
Effort regulation	8,862	19	0.32	[0.29, 0.35]	22.81%	21.20 *ns*	0.35	0.00	0.31	0.39	0	n.a
Help seeking	2,057	8	0.15	[0.08, 0.21]	56.62%	15.71*	0.17	0.01	0.07	0.28	0	n.a
Peer learning	1,137	4	0.13	[−0.06, 0.31]	90.16%	28.60**	0.20	0.02	0.01	0.39	0	n.a
Time/study management	5,847	7	0.22	[0.14, 0.29]	68.80%	17.10**	0.20	0.00	0.15	0.25	0	n.a
Concentration	6,798	12	0.16	[0.14, 0.19]	0.01%	12.77 *ns*	0.18	0.00	0.17	0.20	1	0.17
Students' approach to learning												
Deep approach to learning	5,211	23	0.14	[0.09, 0.18]	60.24%	54.82**	0.03	0.00	−0.03	0.10	0	n.a
Surface approach to learning	4,838	22	−0.18	[−0.25, −0.10]	86.31%	190.31*	−0.19	0.07	−0.52	0.14	4	−0.13
Strategic approach to learning	2,774	15	0.23	[0.17, 0.30]	69.61%	50.09**	0.31	0.02	0.11	0.50	0	n.a
Psychosocial contextual influences												
Social integration	19,028	15	0.04	[−0.02, 0.10]	92.53%	111.98**	0.03	0.01	−0.07	0.13	0	n.a
Academic integration	13,755	11	0.07	[−0.00, 0.14]	93.10%	134.96**	0.13	0.01	0.00	0.26	3	0.11
Institutional integration	19,773	18	0.04	[0.01, 0.08]	72.00%	51.42**	0.03	0.00	−0.03	0.09	7	0.01
Goal commitment	13,098	10	0.15	[0.07, 0.22]	92.01%	53.03**	0.12	0.00	0.06	0.17	0	n.a
Social support	5,840	14	0.08	[0.03, 0.12]	60.39%	36.26**	0.09	0.00	0.03	0.14	3	0.07
Stress (in general)	1,736	8	−0.13	[−0.19, −0.06]	41.21%	12.03 *ns*	−0.14	0.00	−0.21	−0.08	1	−0.14
Academic stress	941	4	−0.12	[−0.21, −0.02]	47.74%	5.89 *ns*	−0.11	0.00	−0.18	−0.04	0	n.a
Depression	6,335	17	−0.10	[−0.17, 0.02]	84.41%	92.91**	0.03	0.01	−0.07	0.13	4	−0.05

Note. r^+ = observed correlation corrected for sampling error; *k* = number of independent associations; CI = confidence interval; I^2 = Higgins and Thompson's (2002) measure of heterogeneity; Q = Cochran's (1954) measure of homogeneity; ρ = true construct correlation corrected for measurement error; *SD* = standard deviation; CV = credibility interval; *L* = lower bound of 80% credibility interval; *H* = higher bound of 80% credibility interval; n.a. = not available; *ns* = nonsignificant.

[a] Number of missing studies. [b] Observed correlation after missing studies imputed using Duval and Tweedie's (2000) trim and fill procedure. [c] Positive direction = female. [d] Positive direction = internal (locus of control).

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

(CVs); finally, based on r^+, an estimation of the number of studies missing due to publication bias is reported and, where this is greater than 0, the corresponding adjusted effect size is also reported. Figure 1 details r^+ and corresponding 95% CIs of the 42 non-intellective constructs.

We applied Cohen's (1992) useful guidelines on interpretation of the magnitude of sample-weighted average correlations (r^+). According to Cohen, $r^+ = .10$ is small, $r^+ = .30$ is medium, and $r^+ = .50$ is large.

Demographics (Sex, Age, Socioeconomic Status) and Traditional Factors (SAT, ACT, High School GPA, A Level Points, and Intelligence)

Correlations between GPA and socioeconomic background, sex, and age indicated that, in general, students from higher socioeconomic backgrounds ($r^+ = .11$, 95% CI [.08, .15]), older students ($r^+ = .08$, 95% CI [.03, .13]), and female students ($r^+ = .09$, 95% CI [.04, .15]) obtained higher grades. These demographic effect size estimates were small.

Measures of high school GPA ($r^+ = .40$, 95% CI [.35, .45]), SAT ($r^+ = .29$, 95% CI [.25, .33]), and ACT ($r^+ =. 40$, 95% CI [.33, .46]) were, as expected, positive and medium-sized correlates of GPA. A level points in the United Kingdom ($r^+ = .25$, 95% CI [.12, .38]) and measures of general intelligence ($r^+ = .20$, 95% CI [.16, .24]) revealed small, positive, average correlations with GPA.

Personality Traits

As expected, conscientiousness, ($r^+ = .19$, 95% CI [.17, .22]) was the strongest correlate of GPA among the Big Five personality factors. None of the remaining Big Five Factors were important correlates of GPA (agreeableness, $r^+ = .07$, 95% CI [.04, .09]; openness, $r^+ = 09$, 95% CI [06, .12]; extraversion, $r^+ = -.04$,

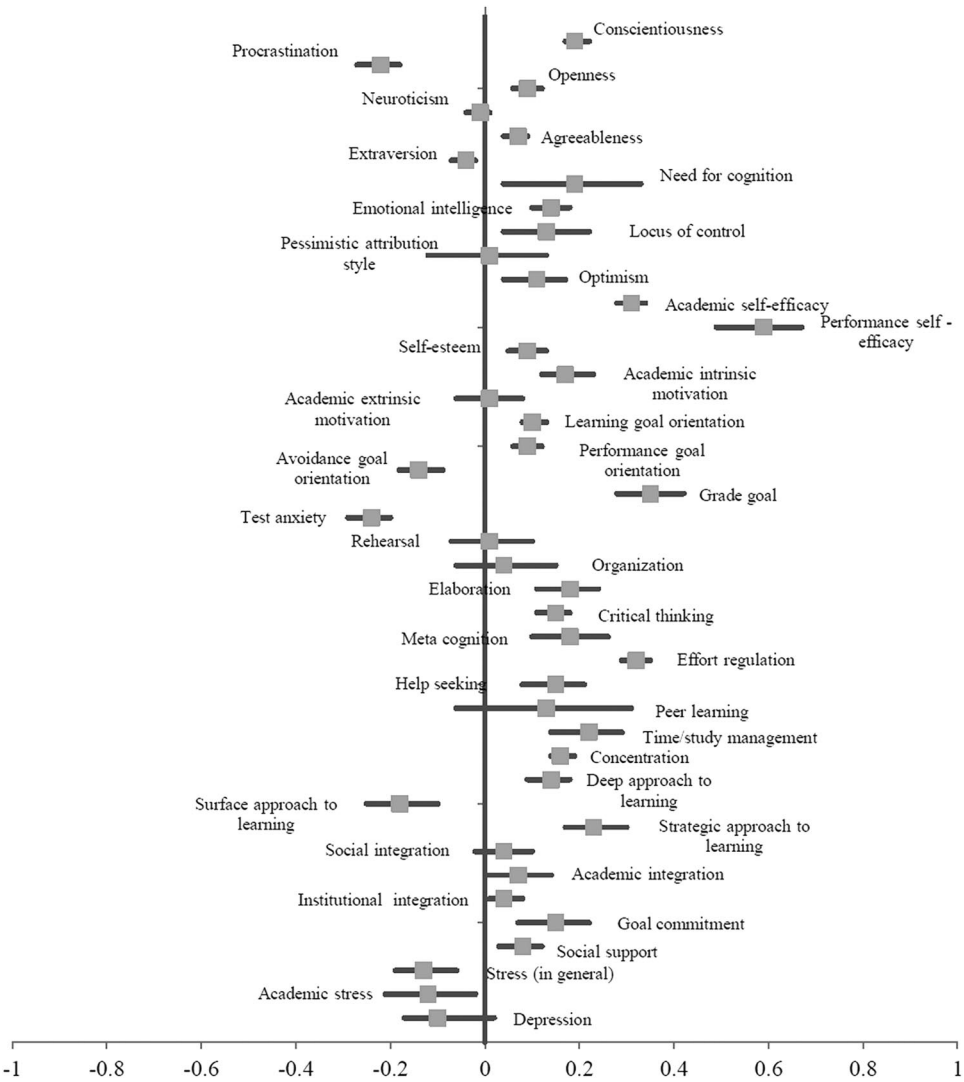

Figure 1. Results of the primary meta-analyses for the non-intellective correlates of GPA: r^+ and 95% confidence intervals.

95% CI [−.07, −.02]; neuroticism, $r^+ = -.01$, 95% CI [−.04, .01]). CIs for neuroticism crossed zero.

Need for cognition ($r^+ = .19$, 95% CI [.04, .33]) and emotional intelligence ($r^+ = .14$, 95% CI [.10, .18]) showed small positive, significant correlations with GPA, whereas procrastination was found to have a small, negative, average correlation with GPA ($r^+ = -.22$, 95% CI [−.27, −.18]).

Motivation Factors

Measures of optimism, locus of control, and self-esteem were found to have small correlations with GPA ($r^+ = .11$, 95% CI [.04, .17]; $r^+ = .13$, 95% CI [.04, .22]; $r^+ = .09$, 95% CI [.05, .13], respectively), whereas pessimistic attributional style (for negative academic events) was unrelated to GPA ($r^+ = .01$, 95% CI [−.12, .13]). With the exception of pessimistic attributional style, CI intervals did not cross zero, indicating that these effects were statistically different from zero.

As expected, academic intrinsic motivation ($r^+ = .17$, 95% CI [.12, .23]) was a small, significant, positive correlate of GPA, whereas academic extrinsic motivation ($r^+ = .01$, 95% CI [−.06, .08]) was not significantly associated with GPA. Learning goal orientation ($r^+ = .10$, 95% CI [.09, .13]) and performance goal orientation ($r^+ = .09$, 95% CI [.06, .12]) were found to have small, positive correlations with GPA, whereas performance avoidance goal orientation showed, as expected, a small negative association with GPA ($r^+ = -.14$, 95% CI [−.18, −.09]). Medium correlations were observed between GPA and academic self-efficacy ($r^+ = .31$, 95% CI [.28, .34]) and grade goal ($r^+ = .35$, 95% CI [.28, .42]). Grade goal was the second largest correlate of GPA. Performance self-efficacy was strongly associated with GPA ($r^+ = .59$, 95% CI [.49, .67]), comprising the largest effect observed.

Self-Regulatory Learning Strategies

Four information processing strategies that represent deep learning—namely, metacognition ($r^+ = .18$, 95% CI [.10, .26]), critical thinking ($r^+ = .15$, 95% CI [.11, .18]), elaboration ($r^+ = .18$, 95% CI [.11, .24]), and concentration ($r^+ = .16$, 95% CI [.14, .19])—were found to have small, significant, positive correlations with GPA. In contrast, measures of organization and rehearsal learning were not significantly associated with GPA ($r^+ = .04$, 95% CI [−.06, .15] and $r^+ = .01$, 95% CI [−.07, .10], respectively).

Considering measures of behavioral self-regulation, we found that time/study management, ($r^+ = .22$, 95% CI [.14, .29]), help seeking ($r^+ = .15$, 95% CI [.08, .21]), and peer learning ($r^+ = .13$, 95% CI [−.06, .31]) were small positive correlates of GPA, although the CI intervals around peer learning crossed zero. Effort regulation ($r^+ = .32$, 95% CI [.29, .35]) showed a medium, positive correlation with GPA, whereas test anxiety ($r^+ = -.24$, 95% CI [−.29, −.20]) showed a small, negative correlation with GPA.

Students' Approaches to Learning

The relation between surface learning and GPA was small and negative ($r^+ = -.18$, 95% CI [−.25, −.10]), whereas deep ($r^+ = .14$, 95% CI [.09, .18]) and strategic ($r^+ = .23$, 95% CI [.17, .30]) approaches to learning were found to have small, positive associations with GPA.

Psychosocial Contextual Influences

Goal commitment was the strongest correlate of GPA from Tinto's (1975) student dropout model but was found to have only a small, positive association with GPA ($r^+ = .15$, 95% CI [.07, .22]). Social ($r^+ = .04$, 95% CI [−.02, .10]), academic ($r^+ = .07$, 95% CI [−.00, .14]), and institutional ($r^+ = .04$, 95% CI [.01, .08]) integration showed very small associations, with CIs for social and academic integration crossing zero, indicating that these effects were not significant. Measures of psychological health and social support were correlated with GPA in the expected direction with small, negative effects of general stress ($r^+ = -.13$, 95% CI [−.19, −.06]) and academic stress, ($r^+ = -.12$, 95% CI [−.21, −.02]) and a small, positive effect of social support ($r^+ = .08$, 95% CI [.03, .12). Depression was found to have a small, negative association ($r^+ = -.10$, 95% CI [−.17, .02]) that was not statistically significant, as indicated by the CI's crossing of zero.

Outliers and Influential Cases

The number of outliers did not exceed $k/10$ (rounded up to the nearest integer value) in any of our analyses. When either the DFFITS value was greater than $3\sqrt{1}/(k–1)$ or the Cook's distance exceeded χ^2, $df = 1$, we reconducted the analysis to recalculate the average effect size with that study excluded. Analyses were reconducted for 22 of the 50 constructs; for all except one analysis, only one outlier had to be excluded according to these criteria. In that analysis, two outliers were excluded, separately. The effect of excluding the outlier was trivial in all but one analysis. The average correlation computed excluding the outlier did not differ by more than 0.05 from that obtained with the outlier included, and in none of these cases did this small discrepancy affect the direction or effect size interpretation. In one analysis (the peer learning/GPA combination), the discrepancy was a little larger than the others (.08), but this association was nonsignificant with and without outliers, as indicated by CIs that crossed zero.

Publication Bias

Duval and Tweedie's trim and fill analyses led to a difference > 0.05 in two of the 50 constructs tested, ACT ($r^+ = .40$ before and $r^+ = .50$ after 7 missing studies imputed) and metacognition ($r = .18$ before and $r^+ = .12$ after 3 missing studies imputed), indicating that publication bias may be a problem for these measures, leading to an underestimation of the effect of ACT and an overestimation of the effect of metacognition on GPA. Because most colleges accept SAT and/or ACT scores, following Robbins et al. (2004) these measures were combined ($r^+ = .34$, 95% CI [.30, .38]) in the cross-domain multivariate models (see below). In the combined SAT/ACT measure, $r^+ = .41$ after 14 missing studies were imputed.

Moderator Analyses

Nine of 42 non-intellective constructs obtained a nonsignificant r^+ as indicated by CIs that crossed zero (neuroticism, pessimistic attributional style, academic extrinsic motivation, rehearsal, orga-

nization, peer learning, social integration, academic integration, and depression). Of the remaining non-intellective constructs, with the exception of procrastination, emotional intelligence, optimism, critical thinking, effort regulation, concentration, stress (in general), and academic stress, the associated Q statistics were significant, and I^2 values large. Additionally, the credibility intervals around the rho correlations were relatively wide, indicating substantial variation in the individual correlations across the studies. Study design (prospective vs. cross-sectional measurement) was examined as a potential moderator, where there was heterogeneity across studies and sufficient data ($k > 4$ in each subgroup) to support these analyses (Borenstein, Hedges, Higgins, & Rothstein, 2009). Sufficient data for 14 constructs were available.

For the moderation analyses, subgroup analysis was performed by grouping the associations by study design (prospective vs. cross-sectional measurement) and assessing heterogeneity between groups using the between-group Q statistic within a mixed effects model. Results revealed no moderating effect for the relations between GPA and conscientiousness, neuroticism, openness, agreeableness, performance goal orientation, avoidance goal orientation, test anxiety, social integration, or social support. Significant between-group Q statistics were found for relationships between GPA and extraversion, academic self-efficacy, self-esteem, learning goal orientation, and academic intrinsic motivation. Table 7 presents the findings of the moderator analyses. For extraversion a lower weighted average correlation was obtained in cross-sectional studies than in prospective studies (mean difference = .08, between-group Q = 7.14, $p < .01$); however, the CI intervals in the cross-sectional subgroup crossed zero, making these effects difficult to interpret. As expected, significantly lower weighted average effect size estimates were obtained for prospective versus cross-sectional studies for relations between GPA and academic self-efficacy (mean difference = .13, between-group Q = 15.80, $p < .001$), self-esteem (mean difference = .11, between-group Q = 7.27, $p < .01$), learning goal orientation (mean difference = .06, between-group Q = 4.49, $p < .05$), and academic intrinsic motivation (mean difference = .14, between-group Q = 7.15, $p < .01$). However, with the exception of academic self-efficacy and learning goal orientation, the CI intervals crossed zero in the prospective subgroups, limiting interpretation of these findings.

Regression Analyses

Cheung and Chan's (2005, 2009) two-stage structural equation modeling (TSSEM) was used to examine regression models within each domain (i.e., personality, motivation, self-regulatory learning, students' approaches to learning, and psychosocial contextual influences). Stage 1 estimates the pooled correlation matrix and its asymptotic covariance matrix; Stage 2 fits the proposed model to the pooled correlation matrix. Where constructs obtained a significant $r^+ > .10$ with GPA and where relevant data were reported in the primary manuscripts, multivariate models were conducted. Table 8 reports the beta coefficients and model statistics for the regression analyses. The table also reports the number of matrices on which each analysis was based and how many of these contained data for all focal constructs. The pooled correlation matrices can be obtained from the first author on request.

Personality trait regression models. Four trait measures obtained $r^+ > .10$ (conscientiousness, procrastination, need for cognition, and emotional intelligence), although no study reported data including all of these measures. However, data for conscientiousness/ procrastination, conscientiousness/need for cognition, and conscientiousness/emotional intelligence combinations were available. Conscientiousness ($\beta = .13$) and procrastination ($\beta = -.17$) accounted for 7% of the variance in GPA, whereas both (a) conscientiousness ($\beta = .17$) and need for cognition ($\beta = .09$) and (b) conscientiousness ($\beta = .18$) and emotional intelligence ($\beta = .11$) accounted for 5% of the variation in GPA.

Motivation factors regression model. Seven constructs obtained $r^+ > .10$: locus of control, optimism, academic self-efficacy, performance self-efficacy, academic intrinsic motivation, avoidance goal orientation, and grade goal. No studies contained

Table 7
Moderator Analyses: Prospective vs. Cross-Sectional Non-Intellective/GPA Associations

Measure	*N*	*k*	r^+	CI_{r+}95%	Between-group Q
Extraversion (all)	19,702	35	−0.04	[−0.07, 0.01]	7.14**
Extraversion (prospective)	5,102	21	−0.08	[−0.12, −0.04]	
Extraversion (cross-sectional)	14,600	14	0.00	[−0.04, 0.05]	
Academic self-efficacy (all)	41,322	49	0.25	[0.23, 0.28]	15.80***
Academic self-efficacy (prospective)	35,171	29	0.23	[0.20, 0.26]	
Academic self-efficacy (cross-sectional)	6,151	20	0.36	[0.30, 0.41]	
Self-esteem (all)	4,006	18	0.07	[0.03, 0.11]	7.27**
Self-esteem (prospective)	1,117	5	0.01	[−0.05, 0.07]	
Self-esteem (cross-sectional)	2,889	13	0.12	[0.07, 0.17]	
Learning goal orientation (all)	13,119	49	0.10	[0.07, 0.12]	4.49*
Learning goal orientation (prospective)	10,033	37	0.09	[0.06, 0.11]	
Learning goal orientation (cross-sectional)	3,086	12	0.15	[0.10, 0.21]	
Academic intrinsic motivation (all)	5,326	12	0.19	[0.15, 0.23]	7.15**
Academic intrinsic motivation (prospective)	3,500	6	0.07	[−0.03, 0.16]	
Academic intrinsic motivation (cross-sectional)	1,826	6	0.21	[0.17, 0.26]	

Note. r^+ = observed correlation corrected for sampling error; *k* = number of independent associations; CI = confidence interval; Q = Cochran's (1954) measure of homogeneity.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 8
Within Domain Regression Models of Academic Achievement

Variable	Personality			Motivation	Self-regulatory learning strategies	Students' approaches to learning
	C; procrastination	C; need for cognition	C; emotional intelligence	Locus of control[a]; ASE; grade goal	E; CT; MC; ER; HS; T/SM	Deep; surface; strategic
β	.13***	.17***	.18***	.02***	.04***	.06***
β	−.17***	.09***	.11***	.10***	.06***	−.14***
β	n.a.	n.a.	n.a.	.31***	.07***	.23***
β	n.a.	n.a.	n.a.	n.a.	.32***	n.a.
β	n.a.	n.a.	n.a.	n.a.	.05***	n.a.
β	n.a	n.a	n.a	n.a.	.02***	n.a.
β	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
R^2	.07	.05	.05	.14	.11	.09
No. correlation matrices	78	73	76	86	40	24
No. correlation matrices including all focal independent variables	2	1	6	1	1	5

Note. Cheung and Chan's (2005, 2009) two-stage analyses take into account the varying number of studies and sample sizes; thus, no single *N* is used in the analyses. For each data set that entered the analyses a correlation matrix including the relevant constructs was produced. These were then combined to generate a pooled correlation matrix to which the proposed model was fitted; constructs entered the model in the order that they are listed. C = conscientiousness; ASE = academic self-efficacy; E = elaboration; CT = critical thinking; MC = metacognition; ER = effort regulation; HS = help seeking; T/SM = time/study management; n.a. = not available.
[a] Positive direction = internal (locus of control).
*** $p < .001$.

all seven measures, but a model including three constructs (locus of control, academic self-efficacy, and grade goal) was tested. In this model 14% of the variance in GPA was explained, with small beta coefficients for locus of control (β = .02) and larger coefficients for academic self-efficacy (β = .10) and grade goals (β = .31).

Self-regulatory learning strategies regression model. Among the self-regulatory strategies, test anxiety, along with several cognitive (elaboration, critical thinking, metacognition, and concentration) and behavioral (effort regulation, help seeking, and time/study management) constructs, obtained an $r^+ > .10$. No study included all of these measures, but a model combining cognitive and behavioral constructs could be tested. Results show that effort regulation (β = .32) was the strongest predictor of GPA, whereas betas for the remaining factors ranged from .02 to .07, collectively accounting for 11% of the variance.

Students' approaches to learning regression model. All three constructs concerning students' approach to learning met the inclusion criteria. The following beta coefficients were obtained for deep (β = .06), surface (β = −.14), and strategic (β = .23) learning; combined, these accounted for 9% of the variance.

Psychosocial contextual influences regression model. Of the psychosocial contextual constructs, stress (in general), stress relating to academia, and goal commitment obtained r^+s $> .10$; however, no study contained all three constructs, so no model was tested.

Cross-Domain Regression Models

We tested a cross-domain model in three stages. First, the predictive utility (meant here in a statistical sense) of each relevant non-intellective predictor was examined separately, after controlling for the traditional correlates (high school GPA and SAT/ACT). Second, we entered non-intellective predictors into a hierarchical regression model in separate steps in accordance with a theoretically specified model proposing that more global and invariant personality traits influence behavior through proximal processes (Bermúdez, 1999; Chen, Gully, Whiteman, & Kilcullen, 2000; Lee, Sheldon, & Turban, 2003; Phillips & Gully, 1997; Roberts & Wood, 2006; Vallerand & Ratelle, 2002). Third, we tested this hierarchical regression model again after adding SAT/ACT and high school GPA.

Five psychological constructs (conscientiousness, academic self-efficacy, grade goals, test anxiety, and effort regulation) were included because (a) their average relation with GPA was relatively strong, (b) they were identified as important predictors in the within-group analyses, and (c) there were sufficient data available to test these associations.

Table 9 shows the intercorrelations between these constructs, GPA, SAT/ACT, and high school GPA. Table 10 shows that conscientiousness (β = .14), effort regulation (β = .22), test anxiety (β = −.13), academic self-efficacy (β = .18), and grade goal (β = .17) were each, individually, significant predictors of GPA in separate regressions controlling for high school GPA and SAT/ACT.

In building the hierarchical regression model, we initially entered conscientiousness, followed by the more situated, proximal measure of effort regulation. Test anxiety, academic self-efficacy, and grade goals were then added sequentially. Conscientiousness explained significant variance, but the coefficient was reduced in size after effort regulation was added to the model. In addition to effort regulation, test anxiety, academic self-efficacy, and grade goal accounted for a unique proportion of variance in GPA collectively, accounting for 20% of the variance.

Table 11 shows the results of this regression model after first controlling for traditional correlates by entering high school GPA

Table 9
Mean Intercorrelations Between Variables Included in Cross Domain Model

Variable	1	2	3	4	5	6	7	8
1. GPA	—	27,875 (69)	13,497 (29)	8,862 (19)	46,570 (67)	2,670 (13)	54,260 (50)	34,724 (46)
2. Conscientiousness	.19	—	749 (3)	2,188 (8)	1,267 (5)	487 (2)	2,083 (8)	2,196 (8)
3. Test anxiety	−.24	−.02	—	4,805 (1)	725 (4)	599 (3)	2,649 (5)	4,942 (2)
4. Effort regulation[a]	.32	.53	−.15	—	244 (2)	177 (1)	2,654 (4)	4,805 (1)
5. Academic self-efficacy	.31	.23	−.48	.30	—	453 (3)	10,362 (7)	5,890 (9)
6. Grade goal	.35	.14	−.30	.34	.40	—	588 (3)	108 (1)
7. SAT/ACT[b]	.34	−.05	−.16	.03	.31	.37	—	8,579 (17)
8. High school GPA	.40	.21	−.23	.37	.21	.37	.24	—

Note. Lower diagonal triangle: mean correlations (r^+) among variables; upper diagonal triangle: sample size and number of samples (in parentheses) from which the means were derived. GPA = grade point average.
[a] Data for the effort regulation/grade goal combination were obtained from an unpublished study conducted at the university of the third author because these data were unavailable in the reviewed studies. [b] SAT and ACT scores were combined for the primary cross-domain analyses.

and SAT/ACT as an initial step, followed by the non-intellective constructs in the order specified above. High school GPA and SAT/ACT collectively explained 22% of the variance in GPA. Addition of these traditional correlates reduced the effects of test anxiety and academic self-efficacy to nonsignificance and that of grade goal to marginal statistical significance. In the final model, after removing conscientiousness and test anxiety, measures of effort regulation (β = .17), academic self-efficacy (β = .11), and grade goal (β = .08) explained an additional 6% of the variance over and above high school GPA and SAT/ACT, so that the four-step model (including SAT/ACT and high school GPA, effort regulation, academic self-efficacy, and grade goal) accounted for 28% of the variance in GPA.

We conducted the same models again, first using the SAT/ACT score adjusted for possible publication bias (r^+ = .41) and second controlling for high school GPA and SAT only. The effect of grade goals was reduced to nonsignificance (β = .06) controlling for the adjusted SAT/ACT score; otherwise, the pattern of results remained the same. The effect of grade goals was restored (β = .10) in the model controlling for SAT and high school GPA. Self-efficacy (β = .13) and effort regulation (β = .15) retained statistical significance.

Discussion

This review synthesized 13 years of research into the antecedents of university students' grade point average (GPA) scores. We read more than 400 papers, which yielded 241 data sets including correlations between tertiary GPA and 50 conceptually distinct constructs. In addition to three demographic factors (age, sex, and socioeconomic status) and five traditional measures of cognitive capacity or prior academic performance (SAT, ACT, intelligence, high school GPA, and A level points), 42 distinct non-intellective constructs were identified. A conceptual analysis of theoretical models and hypotheses underpinning studies of non-intellective constructs highlighted five conceptually overlapping but broadly distinct research domains, namely, investigations of personality traits, motivational factors, self-regulatory learning strategies, students' approaches to learning, and psychosocial contextual influences. In the discussion below, we (a) review the magnitude of average, weighted correlations with tertiary GPA both within and across these five research domains; (b) examine moderation of such associations by cross-sectional versus prospective study design; (c) consider multivariate models accounting for cumulative variance within research domains; (d) discuss cross-domain, multivariate models of tertiary students' potential and the implications for development of assessment inventories; (e) compare our findings to those of pervious reviews; (f) identify limitations of this review; (g) reflect on the design and evaluation of interventions to optimize tertiary student potential; and (h) highlight key conclusions for research and practice.

Magnitude of Average, Weighted, Bivariate Correlations With Tertiary GPA

Drawing upon 1,105 independent correlations, our hypotheses-driven, random effects, meta-analyses revealed that 41 of 50 constructs were significantly associated with GPA. Consistent with

Table 10
Regression Models Examining the Predictive Validity of Non-Intellective Correlates of Grade Point Average (GPA) Controlling for High School GPA and SAT/ACT Scores

Variable entered	Conscientiousness β	Effort regulation β	Test anxiety β	Academic self-efficacy β	Grade goal β
Step 1					
SAT/ACT	.27***	.27***	.25***	.21***	.21***
High school GPA	.31***	.25***	.31***	.31***	.29***
Focal non-intellective predictor	.14***	.22***	−.13***	.18***	.17***
R^2	24	26	24	25	25
Model F	66.26***	74.59***	65.25***	69.96***	67.34***

*** $p < .001$.

Table 11
Hierarchical Regression Model Examining the Incremental Validity Estimates of Non-Intellective Correlates on Grade Point Average Before and After Controlling for High School GPA and SAT/ACT Scores

Variable entered	β	β	β	β	β	β (Model without conscientiousness and test anxiety)
Step 1						
SAT/ACT	.26***	.27***	.28***	.26***	.24***	.22***	.21***
High school GPA	.34***	.31***	.25***	.23***	.24***	.22***	.23***
Step 2						
Conscientiousness		.19*** (.14***)	.03 *ns* (.05 *ns*)	05 *ns* (.06 *ns*)	.02 *ns* (.04 *ns*)	.04 *ns* (.05 *ns*)	n.a.
Step 3						
Effort regulation			.31*** (.19***)	.27*** (.18***)	.23*** (.16***)	.18*** (.15**)	.20*** (.17***)
Step 4						
Test anxiety				−.20*** (−.12**)	−.11** (−.08*)	−.09* (−.07 *ns*)	n.a.
Step 5						
Academic self-efficacy					.19*** (.09*)	.14* (.07 *ns*)	.16** (.11**)
Step 6						
Grade goal						.20*** (.08†)	.22*** (.08*)
R^2	.22	.04 (.24)	.10 (.27)	.14 (.28)	.16 (.28)	.20 (.29)	.19 (.28)
ΔF	89.78***	23.45*** (15.17***)	46.60*** (20.41***)	28.04*** (10.85**)	16.34*** (4.38*)	25.72*** (3.60†)	28.67*** (4.16*)
Model F	89.78***	23.45*** (66.26***)	35.88*** (56.35***)	34.30*** (47.96***)	30.44*** (41.91***)	30.46*** (35.73***)	48.77*** (49.03***)

Note. $N = 628$. Coefficients controlling for high school GPA and SAT/ACT are reported in parentheses. n.a. = not available; *ns* = nonsignificant.
† $p < .07$. * $p < .05$. ** $p < .01$. *** $p < .001$.

previous findings (e.g., Smith & Naylor, 2001), female students, older students, and those from higher socioeconomic backgrounds obtained higher GPAs; however, these effects were small (r^+s = .08–.11).

Measures of general intelligence had a small positive association with GPA but, confirming previous findings (e.g., Robbins et al., 2004), high school GPA, SAT, and ACT were medium-sized (or nearly so) positive correlates (r^+s = .29–.40). Interestingly, ACT was a stronger predictor of GPA than of SAT, especially after imputation of missing studies due to potential publication bias; further research including examination of unpublished literature is needed to validate this finding.

In U.K. data, a small correlation was observed between A level points and university GPA ($r^+ = .25$), again reflecting previous findings (Peers & Johnston, 1994). It may be that use of more standardized national assessments (than in North America) and higher overall grade attainment has attenuated the school–university performance association in the United Kingdom (McDonald, Newton, Whetton, & Benfield, 2001).

Focusing on the largest, average non-intellective correlates by research domain, we found that, of eight personality measures, procrastination (negatively correlated), conscientiousness, and need for cognition were the largest, albeit small, correlates of GPA (r^+s = .19–.22). Next, among 12 motivational factors, medium positive correlations were observed for academic self-efficacy ($r^+ = .31$) and grade goal ($r^+ = .35$), whereas a large positive correlation was found for performance self-efficacy ($r^+ = .59$). Performance self-efficacy and grade goal were the strongest of the 42 non-intellective associations tested. Of 11 measures of self-regulatory capacities, only effort regulation obtained a medium-sized association ($r^+ = .32$), with test anxiety being the next strongest correlate ($r^+ = -.24$).

Small average correlations were observed for measures of three approaches to learning, with strategic ($r^+ = .23$) and surface learning ($r^+ = -.18$) having the strongest effects. Of the eight psychosocial contextual factors, measures of goal commitment, general stress, and academic stress obtained the largest, albeit small, average correlations (r^+s = .15, −.13, −.12, respectively).

Discounting small correlations, performance self-efficacy, grade goal, effort regulation, and academic self-efficacy emerged as the strongest correlates of tertiary GPA, alongside traditional assessments of cognitive capacity and previous performance. This pattern of findings emphasizes the importance of specific, potentially modifiable cognitions and self-regulatory competencies. Measures of relatively more stable individual characteristics (e.g., intelligence, conscientiousness, procrastination), approaches to student learning (superficial, deep, or strategic), and psychosocial contextual factors (e.g., general and academic stress) were not found to have medium or large average correlations with GPA.

Small correlations can, however, be important, especially if they represent population-relevant effects. Consequently, models of GPA antecedents should not necessarily overlook the 22 small-sized correlates identified here (see Table 2 for definitions). For clarity, these are listed by research domain below.

1. Personality traits: procrastination (negatively correlated), conscientiousness, need for cognition, and emotional intelligence.

2. Motivational factors: locus of control, optimism, academic intrinsic motivation, learning goal orientation, and avoidance goal orientation (negatively correlated).

3. Self-regulatory learning strategies: elaboration, critical thinking, use of metacognition, help seeking, time/study management, concentration, and test anxiety (negatively correlated).

4. Approaches to learning: having a strategic, deep, or surface (negatively correlated) approach.

5. Psychosocial contextual influences: goal commitment, experiencing general stress or stress relating to university work (both negatively correlated).

Whether these small associations are of practical importance to the assessment of university students' potential or whether the design of cost-effective interventions to optimize such potential is viable will probably depend on the extent to which they uniquely explain variance in GPA over and above medium and large correlates.

Moderation by Study Design

Available data strictly limited the extent to which we could test moderation effects. Cross-sectional correlations were found to overestimate associations with GPA, compared to prospective tests of academic self-efficacy and learning goal orientation. The same pattern was found for self-esteem and academic intrinsic motivation, although confidence intervals crossed zero in the prospective subgroup. Cross-sectional studies of the extraversion–GPA relation appeared to underestimate the predictive capacity of this personality trait (relative to prospective studies), but confidence intervals in the cross-sectional subgroup crossed zero. These findings emphasize the importance of measuring predictors of academic GPA using prospective (rather than cross-sectional or retrospective) designs.

Within-Domain Multivariate Models

Where possible, we conducted regression analyses to explore the extent to which multivariate models explained cumulative variance in GPA within the five identified research domains. Procrastination, arguably a facet of conscientiousness (Steel, 2007), explained somewhat greater variance in GPA than did conscientiousness itself, suggesting that procrastination may be primarily, although not necessarily exclusively, responsible for the effect of conscientiousness on tertiary GPA. These measures combined accounted for 7% of the variance. Two separate models revealed that need for cognition and emotional intelligence explained additional variance controlling for conscientiousness. Both models accounted for 5% of the variance in GPA. Although personality measures showed only small-sized associations with GPA, these results demonstrate that traits other than those specified by the five-factor model may be important to assessing students' potential.

A model of three motivational constructs (academic self-efficacy, grade goal, and locus of control) explained 14% of variance in GPA, with grade goal being the strongest predictor, followed by academic self-efficacy. Locus of control was not a useful predictor in this multivariate model, underlining the importance of goal setting and self-efficacy.

In the self-regulatory learning domain, a model including six behavioral and cognitive learning strategies accounted for 11% of the variance. Effort regulation was the strongest predictor, followed by metacognition; the remaining measures (elaboration, critical thinking, help seeking, and time/study management) had negligible effects.

The three learning styles—deep, strategic, and surface (negatively correlated)—accounted for 9% of the variance and were found to be independent of one another in a multivariate model. Strategic and surface learning were identified as the strongest predictors.

Collectively, these within-domain, multivariate models indicate that, in addition to the four medium-sized non-intellective correlates of GPA (i.e., effort regulation, academic self-efficacy, performance self-efficacy, and grade goals), aspects of conscientiousness, procrastination, need for cognition, emotional intelligence, metacognition, deep, surface, and strategic learning styles may be independent predictors of GPA.

Cross-Domain Multivariate Models and Assessment Inventories

Ideally we would have drawn upon multiple, multivariate, prospective studies including the strongest correlates of tertiary GPA. Over 13 years of research, however, few such studies have been reported. Consequently, our cross-domain regression analyses were severely limited. We conclude that available data do not permit testing of a comprehensive and parsimonious model of factors that most strongly influence university students' academic attainment (the fifth research challenge we identified). Consequently, at present, construction of integrative, cross-domain, theories modeling predictors of GPA lacks empirical foundation.

Our analysis indicated that, combined, measures of effort regulation, test anxiety, academic self-efficacy, and grade goal accounted for 20% of the variance in GPA. This figure is comparable with the 22% of variance explained by high school GPA and SAT/ACT. After controlling for traditional intellective constructs an additional 6% of the variance in GPA was explained by effort regulation, academic self-efficacy, and grade goals. Conscientiousness and test anxiety did not explain additional variance. When traditional predictors were excluded, grade goal was the strongest predictor among non-intellective measures; however, controlling for SAT/ACT and high school GPA, effort regulation became the strongest predictor and test anxiety was reduced to nonsignificance. This emergence of effort regulation may emphasize the importance of students' volitional capacities in addition to performance-related cognitions (Gollwitzer, 1990; Kuhl, 2000). Academic self-efficacy and grade goal measures may be strongly shaped by performance feedback (Locke & Latham, 1990), which, in academia, is mainly constituted by grade attainment on assignments and exams (Wood & Locke, 1987). Consequently, these cognitions are expected to stabilize with university experience and to have greater predictive validity once skills and performance levels are established (Bandura, 1997; Lent & Brown, 2006). The upshot may be that self-efficacy and grade goal measures are more closely related to measures of cognitive ability (e.g., SAT/ACT) than is effort regulation. If so, this could limit the effectiveness of

interventions focusing on grade goal setting and academic self-efficacy enhancement, but experimental data are needed to test these hypotheses.

Crucially, the effect of performance-related cognitions (including grade goals and academic self-efficacy) and that of specific self-regulatory learning and motivational constructs are likely to be more strongly related with more narrowly defined achievement outcomes, such as task or test achievement (Judge, Jackson, Shaw, Scott, & Rich, 2007), than with more global indexes of GPA (e.g., course and cumulative GPA). As such, these current data are likely to underestimate the impact of these influences on academic achievement. Further prospective research is needed to explore this hypothesis.

The additional variance in GPA explained by effort regulation, academic self-efficacy, and grade goal may be augmented by other constructs we could not include. For example, we could not include performance self-efficacy (the largest average bivariate correlate of GPA) in cross-domain models, so the relationship between these self-predictions of grade attainment and more general measures of academic self-efficacy remains unclear. Similarly, evaluation of the theoretical and practical importance of the 22 small-sized correlates identified here requires further multivariate, prospective research. For example, the effects of learning styles—which, arguably, assess more stable aspects of motivation and self-regulatory capacities—may be mediated by more specific motivation and self-regulatory constructs (e.g., critical thinking, elaboration, metacognition).

Despite the limitations of the available evidence, practical implications are evident. Our results indicate that a combination of motivation (academic self-efficacy, performance efficacy, grade goal) and self-regulatory capacity (effort regulation) predicts tertiary GPA. Table 3 shows how measures in two current multimeasure assessment inventories, the MSLQ and LASSI, map onto constructs included in our analyses (as listed in Table 1). The MSLQ includes two of the four strongest correlates identified here (academic self-efficacy and effort regulation), whereas only effort regulation is included in the LASSI. Of the 22 small correlates of GPA identified in the current review, eight are included in the MSLQ and five are included in the LASSI. The LASSI comprises mainly cognitive (e.g., elaboration) and behavioral (e.g., effort regulation) self-regulatory learning strategies, whereas equal emphasis is given to self-regulatory learning and motivational factors in the MSLQ. Our findings strongly suggest that inclusion of further measures, especially performance-related cognitions, could enhance the predictive utility of these tests. Different sets of constructs may be important to (a) the assessment and (b) the enhancement of students' potential, because even when cognitions or capacities cannot be easily modified they may add to the prediction of students' performance. This may be especially informative in countries and places where cognitive-ability-based assessments are not routinely employed in tertiary-level education (e.g., in the United Kingdom). Therefore, inventories of psychosocial factors may be particularly helpful in identifying students who might benefit from interventions that target improved learning and performance.

Development of an improved multimeasure assessment instrument would provide more parsimonious and reliable assessments for students and teachers. Moreover, administration of such an instrument among large, representative student samples in prospective studies could greatly advance theory development in this field.

Comparison With Previous Reviews

Our results confirmed Robbins et al.'s (2004) conclusions that effort regulation and academic self-efficacy are important correlates of tertiary GPA. In addition, the data show that cognitions specific to academic performance (i.e., performance self-efficacy and grade goal) were the strongest correlates of GPA. The data thus emphasize the importance of goal setting and task-specific self-efficacy.

In a meta-analytic review of the five-factor model of personality and academic performance, Poropat (2009) found that conscientiousness was the only useful predictor of tertiary GPA, controlling for high school GPA (also see O'Connor & Paunonen, 2007). Our results support this conclusion, emphasizing that procrastination may be especially handicapping for tertiary-level students. However, our findings also highlight the potential influence of non-five-factor traits, specifically, need for cognition and emotional intelligence, which explained unique variance in GPA, controlling for conscientiousness.

Poropat (2009) found that conscientiousness added slightly more to GPA prediction than did intelligence and concluded that conscientiousness was a "*comparatively important predictor*" (p. 330). Yet in our cross-domain model, combining correlates identified by Robbins et al. (2004) and Poropat, conscientiousness did not add to the variance explained. The effect of conscientiousness was attenuated once effort regulation was added to the model. A large correlation was observed between conscientiousness and effort regulation ($r^+ = .53$), suggesting a potential mediation model (Richardson & Abraham, 2009). Future studies could profitably explore whether effort regulation is most usefully conceptualized as self-regulatory strategy (as in our review) or regarded as a domain-specific facet of conscientiousness. The latter proposal is consistent with Roberts and Wood's (2006) neo-socioanalytic theory, which provides a distal-proximal framework for integrating personality, motivation, and ability factors at different levels of abstraction. Such distal-proximal, cross-domain, construct relationships can be specified when constructs are correlated and defined so as to relate to common, theoretically specified mechanisms (Roberts & Wood, 2006). Future multivariate, prospective studies are required to test such models.

Contrary to previous reviews of goal orientation (e.g., Payne et al., 2007), our results indicate that performance avoidance goals (not learning orientation goals) are most strongly related to GPA. Consistent with Payne et al. (2007), performance approach orientation was found to be a relatively unimportant predictor. Recent research has indicated that associations with goal orientation constructs differ depending on the measures employed and the sociodemographic characteristics of the sample. Measures of performance-approach goal orientation comprising mainly normatively referenced measures have been found to be positively correlated with GPA, whereas measures composed mainly of appearance and evaluative items are negatively correlated (Hulleman, Schrager, Bodmann, & Harackiewicz, 2010). We concur with Hulleman et al.'s call for greater theory–measurement consistency. Our attempt to integrate this literature has highlighted how a lack of correspondence between theoretically specified mechanisms and corre-

sponding measures impedes evidence synthesis and may slow the resolution of key research questions.

Limitations of This Review

Systematic search techniques were employed to overcome the problem of selection bias, but, unavoidably, five of the univariate analyses were based on five or fewer independent correlations, so restricting the generalizability of findings. The decision to include only published studies could have artificially inflated effect size estimates (Rosenthal, 1979), but with the exception of two measures, namely, ACT and metacognition, Duval and Tweedie's (2000) trim and fill analysis indicated that, in general, publication bias is not a problem for these data.

Range restriction was not coded, so findings may generalize only to students already at university. This coincides with the aim of developing assessment instruments for university students, but findings may not be directly applicable to university admissions decisions. Moreover, few studies sampled students in their first year, so the feasibility of long-range GPA prediction, including that focusing on university applicants, remains to be demonstrated by future, prospective studies.

Insufficient data prevented examination of additional methodological and theoretical moderators including student characteristics (e.g., race, age, sex, socioeconomic status), performance criterion (e.g., test score and coursework grade), and contextual factors (e.g., institutional type). Many confidence intervals and critical values were wide or crossed zero, so the identification of moderators is an important goal for future research.

Regression analyses examining the relative contribution of nonintellective factors required synthesizing correlation matrices despite substantial missing data. Few studies included all the independent variables, and many included only one. Substantial missing data in pooled correlation matrices are likely to result in bias, especially where, under a random effects model, variability in population effect sizes is expected. However, the magnitude and direction of this bias and the effects on the regression analyses cannot be determined.

Our review and the specification of mechanistic models of tertiary-level students' performance are limited by the nature of theoretical and empirical work in this area. A wide range of constructs has been investigated in small subsets in many separate studies. Constructs appear to have been defined by researchers working in particular domains, for example, those focusing on motivational or personality theories, without specification of cross-domain mechanisms. Thus, there is considerable conceptual and item-content overlap across measures. Our evidence synthesis was also hampered by use of variable descriptions of the same constructs across studies. Moreover, several separate measures have been used to assess some constructs (see Table 2), with only a few derived from a rigorous psychometric development process. Overall, the current range of potential antecedents of tertiary GPA is indicative of a proliferation of measures representing fewer underlying mechanistic constructs, making theoretical integration difficult (Eccles & Wigfield, 2002). We conclude that the challenge for researchers in this field is to distill available constructs and measures into a parsimonious, mechanistic model of antecedents of tertiary-level academic achievement represented by reliable, standardized measures that enable short- and long-term prediction of university performance.

Developing Interventions to Enhance University Students' Performance

Until theoretical models are supported by prospective and experimental data, the design of interventions to optimize students' performance will remain a project of invention rather than applied science. Nonetheless, the research reviewed here suggests some potentially effective strategies.

Measures of students' grade goals were among the largest correlates of GPA, suggesting that goal-setting interventions could be effective. Goal theory (Locke & Latham, 1990) recommends setting goals that are specific, challenging, and located within time and context. In a brief goal-setting intervention, Latham and Brown (2006) reported that GPA was significantly higher among students who set their own learning goals than students who set distal performance goals. However, students who set proximal goals (including grade goals), in addition to distal outcome goals, achieved higher GPAs than those who set only distal goals or those who were urged to do their best. Students might also be encouraged to set goals relating to other correlates (e.g., goals relating to help seeking from teachers, avoiding procrastination, or establishing study routines).

Goal setting may also boost effort regulation (another of the strongest correlates) in the form of plans to persist when tasks are difficult. Even if effort regulation and test anxiety are conceptualized as traits rather than learned competencies, evidence suggests that personality traits may be modifiable (e.g., Mroczek & Spiro, 2003) and lower level dispositions may be more malleable (Roberts & Wood, 2006). Hence, interventions to boost effort regulation and to develop self-management competencies to reduce test anxiety may be effective, especially if targeted on the basis of student screening.

Academic and performance self-efficacy were important predictors. Self-efficacy enhancement may be an especially important target because self-efficacy beliefs are partially mediated by measures of grade goal (Chen et al., 2000) and are deemed to be modifiable at a relatively low cost. Bandura (1997) specified four methods for raising self-efficacy, including the facilitation of vicarious learning, mastery experiences, reattribution of responses to physiological sensations, and persuasive communication. More detailed specifications of effective self-efficacy enhancement techniques are available (Abraham, 2012; Ashford, Edmunds, & French, 2010). Teachers' behaviors are likely to be important for boosting and maintaining students' self-efficacy. Setting graded tasks, providing feedback on successful performance, and lowering students' anxiety and stress about coursework, exams, and presentations promote mastery experiences and thereby increase self-efficacy (Stock & Cervone, 1990).

Interventions early in students' university career may be most effective because the strongest correlates identified here, performance self-efficacy and grade goals, are likely to be more fluid during the early stages of skill development (Chen et al., 2000; Lent & Brown, 2006). However, the malleability of these key correlates of performance remains to be established by intervention trials. For example, if grade goal is dependent on previous feedback, which, in turn, is predicted by cognitive ability, setting

grade targets may not be an effective performance-enhancement technique. This remains an empirical question.

Multifaceted interventions may be more effective (Hattie, Biggs, & Purdie, 1996), but interventions targeting specific cognitive changes—for example, elevated grade goals, increased effort regulation, reduced test anxiety, reduced procrastination, and enhanced self-efficacy—could be more cost effective. Moreover, experimental evaluation of such interventions with appropriate measurement of potentially mediating constructs would provide empirical tests of hypothesized relationships between key predictors of tertiary GPA, thereby advancing our understanding of underlying mechanisms.

Finally, although caring for students' well-being is a worthwhile aim in itself, our results suggest that performance-focused interventions are more likely to enhance students' academic achievement (e.g., reducing text anxiety rather than more general counseling or stress management services).

Conclusions

This review of 13 years of research into the correlates of tertiary-level GPA highlights the wealth of theoretical elaboration and empirical testing that has been devoted to understanding why some undergraduates perform better than others. We hope that our integration and synthesis of this work will provide a foundation for more focused research and intervention. To this end, we conclude with four recommendations for future research.

Defining measures. Theoretical and intervention development will be best served by cross-domain collaboration to test standardized, reliable measures derived from clearly specified process models. We recommend that researchers work toward establishment of distinct constructs identified by consensually accepted labels and measured with scales that have been tested for their psychometric properties. We believe that this focus would result in identification of fewer key predictors of GPA.

The present findings suggest improvements to current assessment inventories, in particular, inclusion of the strongest correlates of tertiary GPA. Whether or not key correlates of GPA are subject to effective intervention, they may be useful, independent predictors of subsequent performance.

Conducting multivariate prospective studies. Further prospective studies testing multivariate models with large samples are needed. Ideally, these would include applicants (before arrival) and first-year students followed up through their student careers. Such studies should control for prior educational attainment (at school) and include a range of previously tested cross-domain predictors. Neo-socioanalytic theory, goal theory, and social cognitive theory provide useful theoretical frameworks upon which integrative model testing could be based. It is also critical that research reports provide sufficient detail to facilitate exact replication and allow synthesis of findings in meta-analyses. Such research has the capacity to clarify the strongest predictors controlling for a range of correlates and so identify mediating processes.

Exploring moderators. Equal attention should be paid to identification of conditions that facilitate operation of predictive models of tertiary-level achievement. Research on methodological and theoretical moderating factors exploring when and for whom particular processes or changes influence academic achievement would be theoretically and practically informative.

Testing specific, process-focused interventions. Finally, our review and others have identified a series of potentially modifiable medium-to-large correlates of tertiary GPA, in particular, academic and performance self-efficacy, grade goal setting, and effort regulation. It would be valuable to have experimental data on how easily such cognitions and self-regulatory capacities can be changed, as well as for whom, over what time period, and to what extent do such changes impact on GPA scores. Investment in precisely targeted, theoretically based, interventions could help students optimize their potential and would provide empirical tests of proposed process models of tertiary achievement.

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